ESSENTIALS OF ORAL and FACIAL CANCER



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SECOND EDITION

THE YEAR BOOK PUBLISHERS INC

200 EAST ILLINOIS STREET CHICAGO

Reprinted 1953

Translated into Portuguese and published in Rio de Janeiro, 1956

Second edition, 1957

PRINTED IN U S A

To our wives Rhoda and Esther

Preface to the Second Edition

THE CORDIAL reception given the First Edition of this book by the dental, medical and allied professions both in practice and in the schools has led to this Second Edition The same general purpose was kept in mind in preparing this edition as in writing the First Edition, namely to present the essentials of oral and facial cancer in an easily read style and to include representative, but selected illustrations and diagrams This work was not intended to be an exhaustive treatise but rather to serve only as an introduction to the subject The text was reorganized to give further emphasis to the logical sequence of diagnosis and treatment. A number of new illustrations have been added and others redone. In order to meet repeated requests from teachers and lecturers 35 mm slides of the illustrations of this text have been made available, these can be secured through Clay Adams, Inc., 141 East 25th Street, New York 10 New York.

The recent translation of this text into Portuguese is a welcome step in advancing professional cancer education.

We are grateful to many colleagues for their valuable suggestions and to Dr C. I. Mohammed for his devoted assistance

—B G.S
—I S

Preface to the First Edition

CANCER IS the second greatest cause of death in the United States. This fact has led to the concerted efforts of public and private agencies, of the health professions and of the scientific world to conquer this most tragic illness In the division of responsibility in waging war against cancer, the health professions have a particular and common challenge in the field of oral and facial cancer This challenge is the early recognition of oral and facial cancer, which lies within the special field of competence of the dentist as well as of the physician The dentist's responsibility rests not merely in the diagnosis and treatment of dental disorders He shares with the physician the responsibility for the prevention and diagnosis of oral disease, of both local and systemic origin

This book is dedicated to the early recognition and treatment of cancer of the oral cavity and face It is designed to meet a growing demand for a guidebook and survey of the field of oral and facial cancer and related conditions The text is organized for ready reference in the general practitioner's office and for use in teaching It may be read in its entire sequence or may be used for information on special aspects by referring to individual chapters Selected case histories are presented to illustrate the characteristics of various types of tumors

In order to deal with the problem of oral and facial cancer comprehensively and in its proper relation to the health and to the diseases of the oral cavity and face, consideration is given to such correlative aspects as public health, research, anatomy and physiology and differential diagnosis A selected bibliography is appended for those seeking a more detailed discussion

The material has been obtained from so many sources that individual acknowledgment has not been possible in every instance Grateful

acknowledgment is due to authors who have given permission to reprint certain selections and illustrations from their works In addition, material has been taken freely from the literature prepared by the American Cancer Society and the Tumor Committee of the Connecticut State Dental Society and from textbooks on cancer by Ackerman and Regato Cutler and Buschke, and Blair Moore and Byars. The photographs are those of patients seen primarily in private practice, the University of Illinois Clinics and at Cook County Hospital. Preference was given to illustrations of early lesions

We wish to acknowledge our gratitude to Dr Harry Sicher whose aid was invaluable in the preparation of this text. We also wish to thank, for their assistance in the preparation of most of the illustrations Mrs. Helen Kutuzov for the line drawings and Mr William M Winn for the photographs A grant from the Gertrude Everett Memorial Fund made some of the illustrations possible.

—B G.S
—I.S

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(MANDIBLE AND MAXILLA)

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The Cancer Problem

I

Public Health Aspects of Cancer

CANCER IS a major worldwide problem in public health. It is no respecter of age, race or wealth It strikes on the average, in one of every two homes. These facts have led to concentrated efforts of both private and Federal agencies to control and conquer the disease One hundred million dollars have been spent during the past decade for cancer research and education and for the promotion of early detection, accurate diagnosis and effective treatment.

American Cancer Society—The American Cancer Society organized in 1913 has set as its goal the control of cancer through maximal use of present methods of education, detection and diagnosis and through co-ordinated research for new methods of prevention, diagnosis and treatment. The Society provides financial support for cancer research in many universities and hospitals

The American Cancer Society obtained nearly $27 000 000 in contributions in 1956 It has paid special attention to both lay and professional education by organizing training courses at different levels and by preparing appropriate literature Its educational campaign reaches a climax each April, proclaimed as Cancer Control Month by an act of Congress.

Federal agencies—Private agencies did the spade work which educated the public and paved the way for governmental participation.

In 1937 the Federal Government through the National Cancer Institute of the United States launched a comprehensive program to reduce the death toll of cancer by improved methods of prevention and early diagnosis Beginning with an annual budget of $700 000 in 1937 the funds for the National Cancer Institute have increased to an annual rate of $35 000 000 These funds are for research and fellowships in the Institute and outside institutions for cancer control grants to the

states and for grants for construction of teaching and research buildings

Considerable additional support is derived from the Atomic Energy Commission for basic medical and cancer research This includes the supplying of radioactive elements which may become an effective weapon against cancer In addition to the Federal agencies, numerous state organizations are active in the field of cancer control.

Education for early diagnosis—Early diagnosis is a great factor in the successful control of cancer The educational program of both private and Federal agencies, which has been focused on promoting early diagnosis, is therefore of primary importance It has been pointed out that current cancer mortality could be reduced one-third to one-half if early symptoms were given adequate medical or dental attention Studies have shown that delay in diagnosis has resulted only in part from the ignorance and the neglect of the patient Delay has also been due to failure to make the correct diagnosis by either the first physician or the first dentist who saw the patient.

The percentage of potential "cures" is higher in the mouth, lip and skin than elsewhere. These are the sites that the physician and particularly the dentist can readily observe in their everyday practice It has been estimated that 80 per cent of deaths caused by cancer of the mouth could be averted by early diagnosis and treatment

Results of current efforts—It is difficult to evaluate the immediate prospects of the success of current research activities. Discovery of the causes and methods of cure of cancer, an achievement of first magnitude, will be made, although one cannot foresee when this will be achieved Atomic energy was released in a relatively short time only after the fundamental research in that field had been done Our present basic knowledge of cancer is much more incomplete On the other hand, some definite progress has been achieved in the field of cancer control as a result of earlier diagnosis and improved methods of treatment Recent statistics show that in the United States one-third of those who develop cancer today will survive for five years This is a significant improvement over 1948, when the five year survival rate was about one to four In evaluating the cancer problem, Steiner (88) estimated that the percentage of cures of most cancers could, on the average, be more than doubled with the available knowledge

Incidence of Cancer

One measure of the significance of a disease is its annual toll of lives Among fatal diseases, cancer is, in most age periods, second only to

MALE

Cause of death	AGE 1 14	AGE 15 29	AGE 30 44	AGE 45 59	AGE 60 & over	ALL AGES
1st	Accidents	Accidents	Heart Diseases	Heart Diseases	Heart Diseases	Heart Diseases
2nd	CANCER	CANCER	Accidents	CANCER	CANCER	CANCER
3rd	Pneumonia	Homicide	CANCER	Cerebral Hemorrhage	Cerebral Hemorrhage	Cerebral Hemorrhage
4th	Congenital Mal form.	Heart Diseases	Tuber culosis	Accidents	Accidents	Accidents
5th	Tuber culosis	Tuber culosis	Suicide	Tuber culosis	General Arterio-Sclerosis	Diseases of early infancy
6th	Polio-myelitis	Suicide	Cerebral Hemorrhage	Suicide	Pneumonia	Pneumonia

FEMALE

Cause of death	AGE 1 14	AGE 15 29	AGE 30 44	AGE 45 59	AGE 60 & over	ALL AGES
1st	Accidents	Accidents	CANCER	Heart Diseases	Heart Diseases	Heart Diseases
2nd	Pneumonia	Tuber culosis	Heart Diseases	CANCER	CANCER	CANCER
3rd	CANCER	CANCER	Accidents	Cerebral Hemorrhage	Cerebral Hemorrhage	Cerebral Hemorrhage
4th	Congenital Mal form.	Diseases of Pregnancy	Tuber culosis	Accidents	Accidents	Accidents
5th	Tuber culosis	Heart Diseases	Cerebral Hemorrhage	Tuber culosis	General Arterio-Sclerosis	Diseases of Early Infancy
6th	Gastritis	Homicide	Homicide	Suicide	Pneumonia	Pneumonia

FIG. 1 –The role of cancer among leading causes of death in different age groups of males and females in the United States in 1952. (Courtesy of American Cancer Society 1955)

heart ailments (Fig 1) It is responsible for one of every seven deaths and is the leading fatal disease among women in the fourth and fifth decades.

The annual death rate from cancer had risen to about 229 000 in 1953 about six times that of 1900 This rise does not necessarily indi cate that a higher percentage of the population is developing cancer Not only has the total population increased but, with the prolongation of life expectancy a large proportion of the population reaches the advanced age at which cancer occurs more frequently Other factors

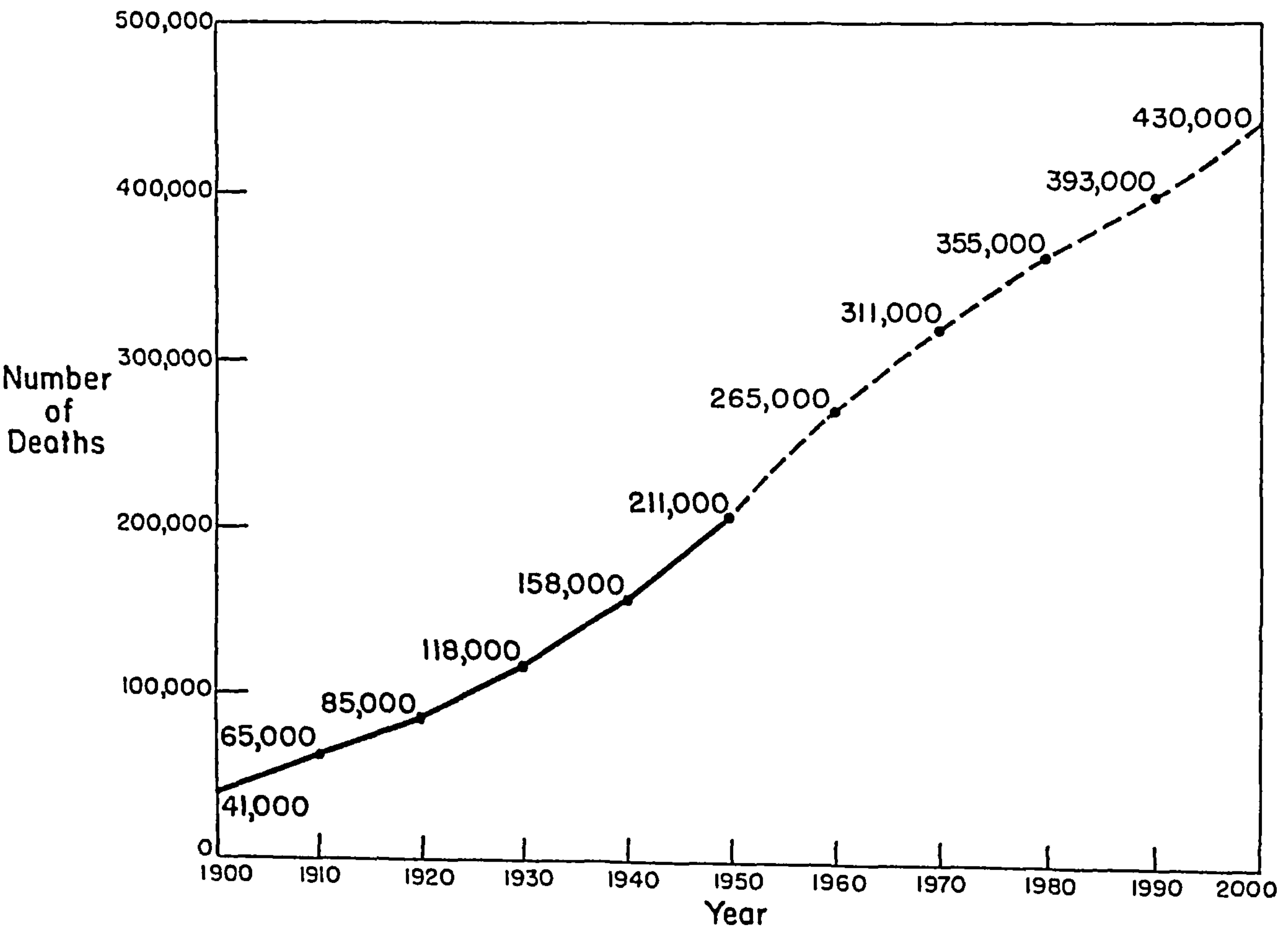


FIG. 2.—If present trends continue, there will be over 400,000 cancer deaths annually in the United States by 2000 A.D. (Courtesy of American Cancer Society.)

such as improved methods of diagnosis which lead to increased recog nition of cancer and improved methods of reporting must also be taken into consideration It appears that cancer will continue to be a challenge for many years Figure 2 gives an estimate of the annual death rate from cancer which is expected to increase to over 420 000 in the year 2000 if present rates continue Thus, with the gift of longer life there is the increased possibility of cancer Even with our present limited knowledge, however current and expected cancer mortality could be reduced by one third to one half if the symptoms were recog

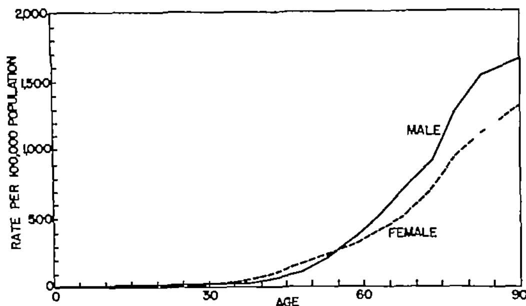


Fig 3.—After 55 the cancer death rate in males exceeds that in females (United States, 1952) (Courtesy of American Cancer Society)

nized early This fact presents a serious challenge to the health professions.

Although cancer morbidity figures are not available, it has been esti mated that the total number of cancer cases is approximately three times the total number of cancer deaths Dr Clarence C. Little a lead ing authority on the subject, has pointed out "Beyond the 200 000 individuals dying each year of cancer there are probably from 500 000 to 750 000 others with the disease and another 300 000 with precancerous conditions that could and should be detected by proper exam ination and diagnosis" The economic cost of cancer to society has been estimated to amount to about twelve billion dollars a year

Age —The incidence of cancer varies with age sex, race, occupation

and site No age is cancer-free Infants have been known to be born with cancer Neoplasms grow more rapidly and metastasize earlier in the young Sarcoma is the common tumor in children and is one of the leading causes of death in childhood (13, 60, 66) Thus more children die of cancer, particularly leukemia, than of infectious diseases The incidence increases with age and is highest after middle life (Fig 3) The fact that cancer is no respecter of any age has led to the slogan of the American Cancer Society "When the patient is over 40, think of cancer first, when the patient is under 40, think of cancer too'"

Sex —More men than women suffer from cancer Cancer is the greatest killer of women in the fourth and fifth decades After age 55, the incidence of cancer deaths is higher in men than in women (Fig. 3)

A striking difference in incidence is found in cancer of the buccal cavity and pharynx, which is four times more frequent in men than in women. Cancer of the skin also occurs more frequently in men

Race —There are interesting racial differences in cancer frequency. Cancer of the breast is less common in Japanese women than in other women Negroes have less cancer of the skin, lip and mouth than have others These differences appear to be the result of diverse extraneous factors rather than of inherent racial characteristics For example, a remarkable freedom from cancer of the penis has been observed among people who practice ritual circumcision (Mohammedans and Jews)

Occupation —Among occupational hazards conducive to an increased incidence of cancer is work with x-rays and other radioactive material without proper protection (54, 61, 82, 87) It has been estimated that 50 per cent of the uranium miners at Joachimsthal, Czechoslovakia, and up to 80 per cent of the cobalt miners in the radioactive mines at Schneeberg, die of lung cancer, most probably as a result of the inhalation of radioactive particles

Fishermen who work with tar in the preparation of nets, and sailors and farmers who are subject to prolonged outdoor exposure (sun and wind), show a high rate of lip and skin cancer (87) This fact has led to the popular designation of this type of cancer as "farmers'" or "sailors'" skin

Occupational cancers occur predominantly in males, since they come in contact with industrial carcinogens more frequently than females Occupational cancer is of major concern to the environmental cancer section of the National Cancer Institute, which was established to concentrate on the industrial aspects of cancer control

Sites —Cancer of the digestive system leads the fatality list (Fig 4);

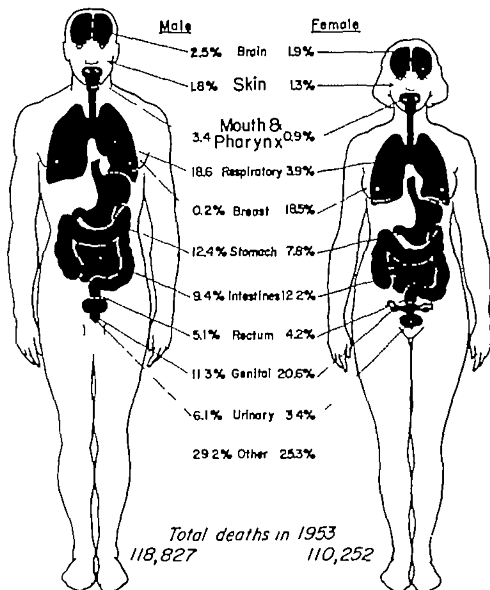


Fig. 4 —Cancer deaths in the United States in 1953 according to sites.

however in terms of but a single organ the most common site in men is the respiratory system and in women the breast. Other organs such as the skin and mouth, also show a high frequency but since they are more accessible and therefore more readily treated than the gastrointestinal tract, they show comparatively lower death rates For the same reason the oral cavity shows a relatively low cancer death rate Oral cancer nevertheless takes an annual toll of about 6,000 persons

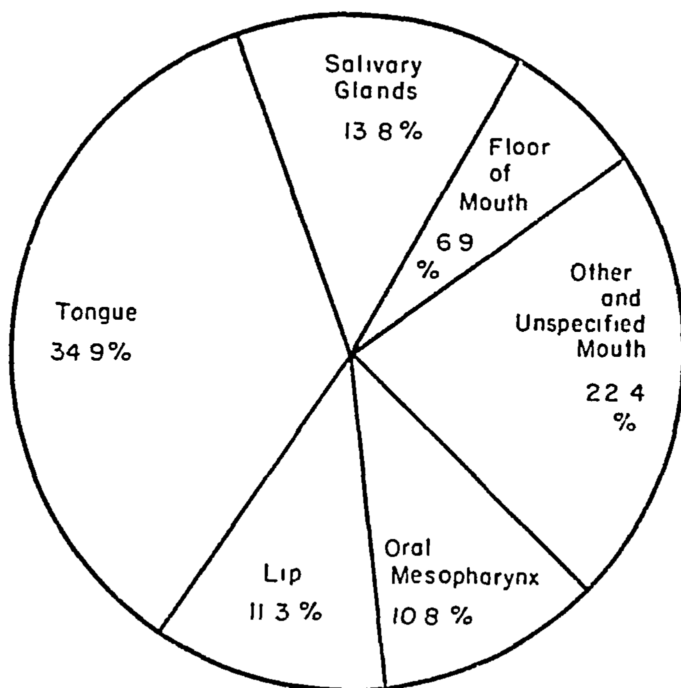


FIG 5—Percentage distribution of deaths from cancer of the oral cavity in the United States in 1953 (Courtesy of American Cancer Society)

in the United States Figure 5 illustrates the percentage distribution of deaths from cancer in the oral cavity

In a survey in the state of Connecticut (11), cancer of the head and neck constituted more than 10 per cent of all cancer, and oral cancer constituted about 5 per cent of the total studies. These are the fields in which the constantly alert dentist occupies a strategic position About 40 per cent of cancers of the head and neck and 60 per cent of cancers of the gingiva are first seen by the dentist It has been estimated that in a hypothetical group of 100,000 adults, sixteen men and three women develop cancer of the mouth (21)



Present Status of Cancer Research*

The wide scope of cancer research can best be appreciated by recognition that cancer includes a large group of diseases characterized by unrestrained growth which, if uninterrupted, ultimately leads to the death of the host. Cancer research of all the studies regarding the illnesses of mankind, therefore possesses the unique distinction of being primarily concerned with the fundamentals of both normal and abnormal growth The earliest references to clinical cancer may be found in the writings of Hippocrates (460–375 B.C.) Systematized cancer research, however began early in the twentieth century following the great advances in the physical and biologic sciences during the nineteenth century

Cancer research may be divided into the following fields of study (1) the causes of cancer induction or experimental carcinogenesis (2) the nature of the neoplastic changes at the site of origin (3) the biologic behavior of cancer in the clinical host, (4) advances in the clinical diagnosis and therapy of cancer (5) studies on the epidemiology frequency and incidence of cancer

These divisions are arbitrary and workers in institutions may pursue one, several or all in a correlated program of research. In addition, cancer research utilizes methods and data fundamental to or derived from practically all of the basic and clinical sciences These include biochemistry physiology genetics, nutrition, microbiology and pathology in the biologic area and analytical and synthetic chemistry physics and radioactivity in the physical sciences. Such recently developed technics as tissue culture and cytology are finding application in an ever broadening manner

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* We are grateful to Dr Paul Kotin who helped generously in the rewriting of this chapter

Research in Experimental Carcinogenesis

The fundamental concepts of the etiology of cancer have traditionally followed two divergent paths one concept maintains that cancer is primarily infectious in origin, the other that cancer results from altered biochemical activity within the cell Abnormal cellular growth characterized by the loss of normal restraint and control and loss in differentiation is typical of all cancer (Fig 6). Adherents of the infectious theory incriminate the virus, suggesting that, since some ani-

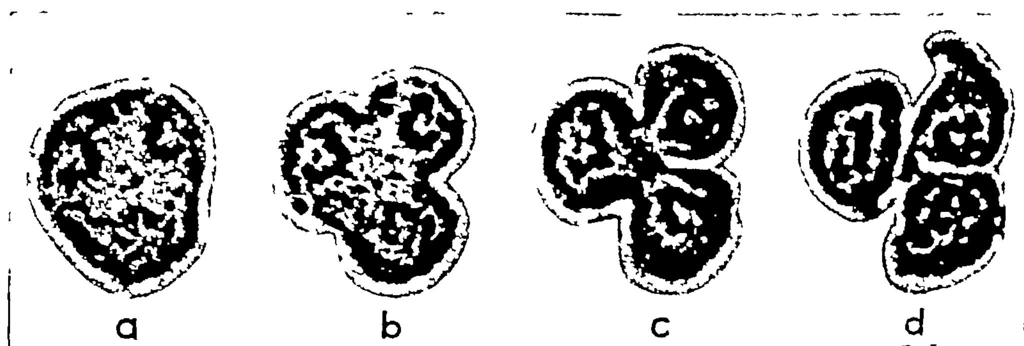


Fig 6 —Stages of mitotic tripolar division of the living sarcoma cell *a,* chromosomes have moved to three poles of the cell, *b-d,* succeeding stages of division of same cell Indirect cell division is usually bipolar except in the cancer cell or when cellular poisons have been added (From a motion picture "The Dividing Cancer Cells in Vitro" by Warren H Lewis)

mal cancers are of known viral etiology, it may be possible that all cancers are of viral causation

The preponderance of opinion adheres to the concept of a noninfectious etiology of human cancer While considerable knowledge has been accrued relative to cancer-producing agents, little specific information exists as to the modifying effect of internal factors A list of agents known to be associated with cancer production include (1) certain aromatic polycyclic hydrocarbons, (2) irritating agents of a mechanical or chemical nature, (3) physical factors, such as actinic rays and radiation, (4) certain infectious agents, including viruses and parasites Internal factors thought capable of modifying the response of the host to these external agents include genetic elements and hormonal, nutritional and chronologic factors (Fig 7)

Aromatic polycyclic hydrocarbons —The discovery of cancer of the scrotum in chimney sweeps by Pott (29) in 1775 led to the eventual production of the first experimental tumors in animals Yamagawa and

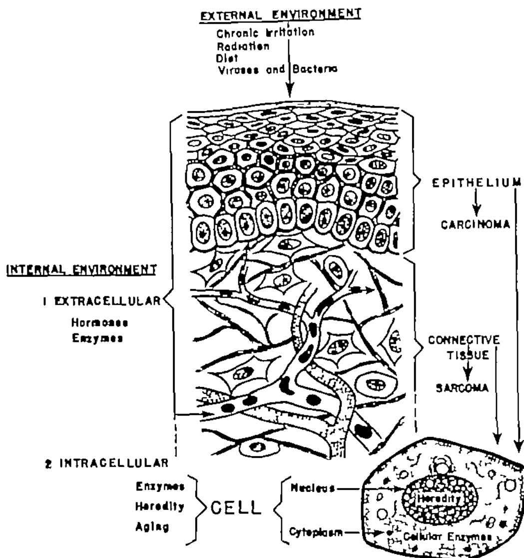


Fig 7 —Possible etiologic factors in the production of cancer classified according to external and internal environment.

Ichikawa (92) in 1915 produced tumors in animals following the long continued painting of rabbits ears with coal tar This was followed by the identification of the first cancer producing hydrocarbon in 1,2,5 6-dibenzanthracene in 1930 by Kennaway and Hieger (71) in Great Britain Since that time a large number of chemically related hydrocarbons have been shown to possess experimental cancer producing potencies (19)

Irritating agents of a mechanical or chemical nature —It has been known for a long time that chronic irritation of either a mechanical or

chemical nature may play a role in the production of cancer Mechanical irritants such as ill-fitting dentures or rough, jagged teeth have thus been considered in relation to oral cancer Burns which alternately heal and ulcerate may eventuate in cancer (Fig 36, p 113) Mouth cancer, for example, is unusually frequent among members of a certain sect in India who smoke cigars with the lighted end in the mouth Here a multiple source of irritation exists—frequent burns and concentrated doses of tobacco tars A high incidence of cancer of the mouth has been found in India and the Philippines, where chewing tobacco–betel nut quids is common The question of whether tobacco is a carcinogenic agent is controversial at present

The role of irritation in cancer production has been the subject of

TABLE 1 —Nature of Initiating Action and Promoting Action in Carcinogenesis

Initiation	Promotion
Effect is specific (carcinogen is required)	Effect is nonspecific (irritants, freezing and wound-healing produce effect)
Action is sudden (*possibly instantaneous, as in mutation*)	Action is prolonged (*probably responsible for pro-longed and slow development of cancer*)
Effect is irreversible (actual tumor yields equal calculated yield)	Effect is reversible, early (effect may be transient below threshold level)

much recent study The induction of cancer is generally accepted as having two stages—initiation and promotion (47) The initiating agents possess the power to induce cancer on the basis of innate chemical, physical or mechanical properties and are referred to as "carcinogens" In the presence of a sufficient dose, their activity in the normal course of events inevitably results in cancer In less than cancer-producing doses, certain nonspecific agents may promote the activity of the carcinogens so that clinical cancer can also result The promoting agent's effect is nonspecific, prolonged and, up to a point, reversible It is probably into this latter group (promotion stage) that chronic irritation falls Cancer may not appear until after many years of chronic irritation The dentist should, therefore, eliminate or reduce all chronic irritation in the mouth Table 1 outlines the essential differences between the stages of initiation and promotion (73)

Physical factors —Radiation energy varies on the basis of wave length

and penetrability Excessive exposure to actinic rays has been known to result in an increased incidence of skin cancer in certain occupationally exposed groups such as sailors and farmers Table 2 shows that the rate of skin cancer in given cities is in direct proportion to the amount of average annual sunlight.

Radiant energy associated with the use of x ray radium or radioactive isotopes apparently has the power of cancer initiation as well as promotion Before the advent of the atomic age exposures were almost exclusively occupational in type. The dentist who in his office, carelessly exposed himself to the carcinogenic effects of x rays (Fig 121 p 274) the miners of radioactive ores and the industrial users of radium, as in the case of the radium dial painters—all provide examples of radiation induced cancer and related problems

The degree of exposure may be relatively slight but still of grave

TABLE 2.—Relation of Intensity of Sunlight to Skin Cancers

Skin Cancers per 100,000 Population	City	% of Total Possible Sunlight
140	Dallas	60–80
129	New Orleans	62–64
37	Pittsburgh	50–57
24	Detroit	40-25

Courtesy of W C. Hueper National Cancer Institute

consequence if the exposure extends over a long period or if the susceptibility of the individual is high X ray or radium treatment of non malignant, dermatologic or other diseases has resulted in cancer of the irradiated tissues in some patients

Leukemia was found among New Jersey factory girls who had painted luminous watch dials with brushes which they had pointed with their lips Many of these girls swallowed and absorbed sufficient radium to cause bone destruction and loss of teeth (Fig 118, p 265) and, in some death It is interesting to note that the first recognition of this involvement came through the diagnosis of osteonecrosis of the jaws made by a dental consultant (49)

A general population hazard has arisen since the use of atomic weapons Evidence of this hazard has been observed in the increased incidence of leukemia in persons who survived the atomic bombing of Hiroshima and Nagasaki.

Infectious agents—Viruses have unequivocally been established as carcinogenic for various species of animals particularly in birds, rab-

bits and frogs. There is no evidence at present, however, that viruses play any role in the induction of cancer in man. Cancer is regarded as being neither infectious nor contagious. Bacteria have never been associated with cancer induction in any species. An increased liability to the development of cancer has been noted in persons infested with certain parasites. Examples include liver cancer in persons infested with liver flukes and urinary bladder cancer in persons infested with Bilharzia.

Nature of Neoplastic Changes at Site of Origin

Intensive studies are in progress aimed at demonstrating local changes in tissues during the development of experimental cancers and subsequent to the establishment of cancers in humans. A loose correlation has been demonstrated between the progressive decrease in organization and function of neoplastic tissue and alterations in enzymatic activity in cancer cells. Ayre and Ayre (45), discussing the antagonistic relation between cellular proliferation and cellular differentiation, have pointed out that in normal circumstances the enzyme systems responsible for differentiation utilize the available cellular energy, thus slowing proliferation. If the enzyme systems specific for differentiation are impaired, cellular energy is not utilized properly and becomes available to the more primitive reproduction enzyme systems, with resultant excessive and uncontrolled cellular growth. These workers have, therefore, suggested that cancer may be produced by the impairment of one of the enzymes on which the specialized function of the cells depends.

Warburg (37), in basic studies, established that cancer cells are capable of glycolysis under both aerobic and anaerobic conditions. Normal cells possess the power of accumulating lactic acid primarily in an aerobic environment. One basic difference between normal and cancer cells has thus been established. Other qualitative biochemical differences between cancer cells and normal cells have as yet not been found.

The response to the numerous carcinogenic chemical compounds that have been administered to experimental animals differs in the various tissues. Thus, methylcholanthrene produces carcinoma in the epithelium when applied topically and sarcoma in the underlying connective tissue when given by subcutaneous injection. Oral structures have also shown selective responses. Topical applications of carcinogens in

hamsters and mice cause no response in the oral mucosa but produce carcinoma in the cutaneous portion of the lip (77)

BIOLOGICAL BEHAVIOR OF CANCER IN CLINICAL HOST

The natural history of cancer indicates that a balance exists between the host and its cancer Internal factors have been shown to affect this balance and to modify the course of cancer

Endocrine glands –Steroid sex hormones have been shown to be intimately associated not only with the induction of cancer in experimental species but also with the modification of the course as well In animals this applies to visceral cancers and leukemia, as well as to cancer of the sexual and accessory sexual organs While no such specific association with the induction of cancer has been demonstrated in man, the clinical course has been shown to be strongly affected by alterations in the steroidal state of patients with cancer Androgens have been shown to have a palliative effect in the treatment of mammary cancer in premenopausal women, while the same effect has been noted in postmenopausal women following the use of estrogens (78)

Estrogenic materials have been used for many years in the treatment of cancer of the prostate (69) It should be remembered that the steroidal state of the host may be altered by the surgical removal, or destruction by radiation, of the gonads the adrenals or most recently the hypophysis itself as well as by administering hormones

Nutrition –In a manner slightly analogous to that of the endocrine glands, nutritional factors have been associated both with the induction of cancer and with the modification of its clinical course or natural history Dietary deficiencies especially associated with the vitamin B group may be significant in the etiology of oral cancer The incidence of cancer of the esophagus in Scandinavian women of low economic status with Plummer Vinson syndrome has been long known. The role of vitamin B deficiency in the pathogenesis of this condition is under study Thyroid cancer appears to be higher in population groups showing a dietary iodine deficiency with its associated endemic goiter It has been shown experimentally that spontaneous as well as induced, tumors appear less frequently and develop more slowly in appropriate strains of mice following restriction of their caloric intake. All that can be said of caloric intake in the incidence of cancer in man is that life insurance statistics show an increased incidence of cancer in the patients who are overweight.

Patients with cancer have been known to develop cachexia and emaciation despite relatively small neoplasms and in the presence of an adequate dietary intake A suggested explanation is that the cancer has a prior claim on ingested nutritional elements, so that the energy and growth requirements of the cancer are met before those of the patient In relation to proteins, cancers have been referred to as "nitrogen traps" (84)

Aging—While some of the increasing incidence of cancer may be related to the increase in life span of the general population, it would appear that the role of aging, per se, is of little significance in the causation of cancer. This can be especially noted in environmentally or exogenously caused cancers, where the dose of the carcinogen and the frequency of exposure appear to be of greater significance than the age of the patient exposed Exposure to low doses of the carcinogen quite naturally requires longer periods, often measurable in decades, prior to the manifestation of clinical cancer

Heredity—The role of genetic factors in the development of human cancer is at present indeterminate Selective breeding has resulted in the development of highly tumor-resistant and highly tumor-susceptible strains of mice, but obviously no such parallel exists in the human experience Hueper, in discussing the role of heredity, observed that "conclusions drawn from selectively inbred strains of mice, a notorious biologic artifact without parallel in nature, have been instrumental in giving to hereditary factors an exaggerated and distorted significance as immediate causes of human cancer" (67)

No established pattern of hereditary transmission of cancer exists in man except in the rare instances of retinoblastoma and the preneoplastic condition of multiple polyposis of the colon While it would appear that cancer susceptibility might be an inherited factor, even this is open to great question Although so-called "cancer families" have been described, they have all presumably been exposed to similar environmental factors and agents whose significance in the development of cancer must be determined

Advances in Clinical Diagnosis and Therapy of Cancer

Prevention represents the primary goal in cancer research Progress in the early detection of cancer and more effective treatment are im-

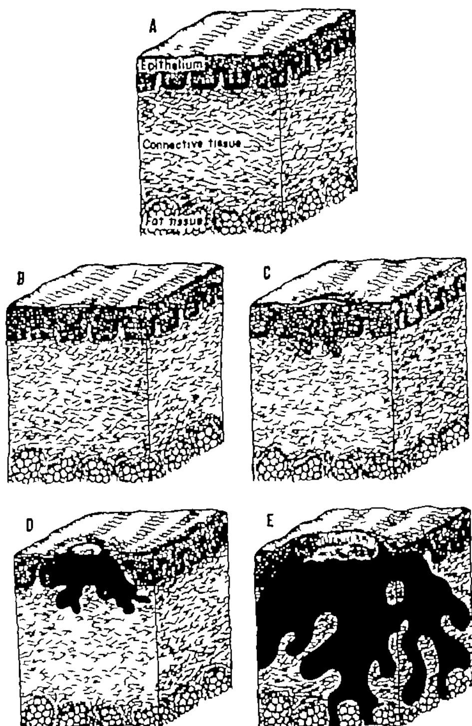


FIG. 8.—Diagram of histogenesis of a carcinoma correlated with gross clinical findings. *A*, normal, *B* subclinical stage (incipiency—carcinoma in situ) *C* early clinical stage (nodule) *D* advanced clinical stage (ulcer) *E* far advanced clinical stage (metastasis)

perative, since the cure rate of cancer is dependent on the t
nosis

Diligent and intensive research is in progress, aimed at i
ment of a diagnostic test in the preclinical phase of canc
Regrettably, no test has as yet been developed to fulfil this
sequently, current methods of diagnosis depend primarily
signs and symptoms Unfortunately, these signs, althoug
and acted on very quickly, generally occur late in terms of
history of the cancer This is so for most visceral cancers,
prognosis is still associated with the diagnosis

Cancer diagnostic tests—As mentioned earlier, cancer
vided into the stages of initiation and promotion A test
the presence of cancer during or immediately following i
initiation appears most unlikely If one were to divide the p
development stage into the two separate phases of subcli
and clinical cancer, a test to establish the presence of ca
the subclinical phase appears quite conceivable The kno
cancer is a group of diseases, rather than a single one, in
corollary that a myriad of tests may be necessary for the
cancers that exist

During the subclinical phase of cancer, metabolic alt
known to take place, some of which are related to the spe
cancer present while others are related to the neoplastic
general An example of the former is the presence of a
amount of phosphatase in the blood, an indication of the
prostatic cancer or bone cancer Variations in the excretion
steroids in patients with certain types of genital tract c
some breast cancers similarly reflect metabolic changes

Nonspecific changes related to cancer in general have th
demonstrated in experimental species, chiefly on the enzy
An example can be found in the reduction of catalase in th
kidneys and an increase in the blood proteoses with cance
sites.

A recent method suggested for the detection of cancer
preclinical phase relates to the use of screening technics on
lation groups Films taken during the annual chest x-ray
the Tuberculosis Association are being analyzed for the
occult foci of cancer of the lung as well as of tuberculosis

Exfoliative cytology—Exfoliative cytology is the study of
cells obtained from body orifices during the course of routi

examinations in the private physician's office or during visits to cancer diagnostic clinics. It has been demonstrated experimentally that cancer cells have a weaker cohesive bond than do normal cells and therefore tend to exfoliate or peel off either spontaneously or in response to slight mechanical pressure Thus, when these cells are found under the microscope by appropriately trained personnel, the presence of cancer can be strongly suspected. However under no circumstances should a final diagnosis or definitive therapy of cancer be undertaken on the basis of the cytologic examination alone In addition to specimens taken from the vaginal tract on routine physical examination, specimens can be obtained from the tracheobronchial tree, the stomach the esophagus and other body orifices when the presence of cancer is suspected. In relation to oral cancer the study of exfoliated cells of the oral mucosa is of limited diagnostic value, since the region is so readily accessible and visible

Clinical diagnosis.—While a cancer may be clinically early in terms of its production of signs and symptoms, it is most frequently biologically late at this time so that successful treatment, except for superficial cancers of the skin, is accompanied by limited success Nevertheless, treatment should be instituted at the earliest possible moment with the view of allowing as little time lapse as possible between the onset of signs and symptoms and definitive therapy

Therapy.—In addition to the traditional methods of cancer treatment by removal through surgery and the destruction of tissues by radiation, recent advances in therapy have introduced the use of antimetabolic agents and hormonal products Subsequent to definitive cancer therapy reconstruction and repair have utilized surgical and prosthetic methods

Surgical treatment.—The surgical treatment of cancer has not changed materially in the past 50 years However with improved care of the patient, a more radical type of surgery can now be undertaken Cancers of the lung and the pancreas that 25 years ago would have been labeled "inoperable" can now be treated with an expectation of success The frequent need for radical surgery becomes apparent when it is realized that one single malignant cell, allowed to remain, is sufficient for the continued growth of the cancer

Preoperative blood transfusions and special diets give the patient added protection Operative procedures have been enhanced by the new anesthetic agents and improved methods of administering them. Postoperative use of blood transfusions, amino acids, vitamins and chemotherapeutic agents has greatly reduced postoperative risks

Radiation therapy—Methods of radiation have greatly improved with the development of high voltage precision tubes which permit intensive treatment of deep cancer without harming the overlying healthy tissue. There is further hope from the radiation generated in machines like the cyclotron and betatron Such high voltage x-rays have their maximal concentration approximately 1½ in inside the surface of the body In addition to radium, radon, which is a gaseous by-product of radium, is available in small hollow gold or platinum capsules or seeds Radioactive cobalt, which is much less expensive than radium, is also being used clinically

Advances in the control of atomic energy have facilitated the preparation of radioactive isotopes, which are becoming available for cancer research and therapy For example, radioactive iodine, which has an affinity for thyroid cells, has been used effectively in the treatment of cancer of the thyroid In addition, radioactive iodine can be traced with the Geiger counter to locate metastases of thyroid cancer Lawrence and his co-workers have reported beneficial results of the treatment of leukemia with radioactive phosphorus

Cancers of the serous body cavities associated with marked exudation of fluid have been treated by means of local instillation of radioactive gold or chromium The effect, though transient, results in a marked diminution, often for long periods of time, of fluid accumulation in the chest or abdominal cavity

Chemotherapy—The assumption that malignant cells differ from normal cells chemically as well as anatomically has led to a constant search for chemical compounds which can retard the growth of malignant cells The enormous strides that have been made in the treatment of infectious diseases by means of chemotherapy have encouraged the hope of similar success in the conquest of cancer

In 1955 a Committee on Chemotherapy of the National Advisory Council was established for the purpose of co-ordinating methods of study for the development of chemotherapeutic agents Representatives from Federal and private agencies concerned with cancer chemotherapy constitute the membership of this committee, which has a permanent secretary who is the Chief of the Cancer Chemotherapy National Service Center in Bethesda, Maryland

The greatest success obtained to date through the use of chemotherapeutic agents has been with agents directed at interfering selectively with the nucleic acid synthesis of cancer cells. These antimetabolites have found their most universal application in the treat-

ment of malignant lymphomas and leukemias Their use in conjunction with radiation has in many instances been found to enhance the effectiveness of both forms of treatment.

Hormonal therapy—Cancers of the genital tract and mammary cancer have been the prime targets of hormonal therapy With the accompanying use of the ever expanding number of steroids being isolated or synthesized, the palliative treatment of cancer has been increasingly successful. As with all other methods of therapy the effects are only transient but nevertheless great temporary remission of both the cancer and its signs and symptoms has frequently been noted

Reconstruction (surgical and prosthetic)—A deformity frequently follows surgical or radiation therapy especially of cancer of the face and jaws Such a deformity can be corrected either by reconstructive surgery or by a prosthesis.

The advances in reconstructive surgery have been based essentially on the same factors which have advanced the horizons of surgery in general—namely improved preoperative, operative and postoperative care. The general principles of reconstructive surgery have remained unchanged during the last 50 years However new technics and modifications of old technics are constantly being reported.

The frontiers in the field of prosthetic reconstruction are being continuously advanced by the development of new and improved materials (e g acrylics and other plastics)

Studies on the Epidemiology Frequency and Incidence of Cancer

The recent increase in cancer of the lung has re-emphasized the value of studying cancer from an epidemiologic viewpoint. The geographic studies of cancer incidence by Steiner (34) as well as the studies on occupational cancer by Hueper (68) have emphasized characteristics of cancer which have been guides to both the experimentalist and the clinician in cancer research. Although geographic pathology in terms of cancer is first being established as a scientific discipline, it offers great hope for the future in terms of elucidating the role of racial, social and other environmental factors in the development of cancer

Socioeconomic status residence site (urban rural) social habits and mores have all been shown to be related to various patterns of cancer incidence

Questions for Students

1 Why is cancer diagnosed more frequently now than 50 years ago?

2 What percentage of the population will get cancer?

3 What is the death rate of cancer as compared to other diseases?

4 How many people in the United States die of cancer each year? What percentage die of oral cancer?

5 About what percentage of cancer occurs in the oral cavity and skin?

6 Are there differences in sex, race and occupation in regard to oral and skin cancer?

7 Is cancer limited exclusively to people over 40?

8 How far may one go in supplying information to the lay public? Is it proper and good taste to show the public clinical photographs in an educational meeting? Are laymen prepared to receive this impact?

9 What are the principal methods of research being used to attack the cancer problem?

10 What are the possibilities of finding a cure for cancer soon?

11 What role does atomic research play in the cancer problem?

12 What are some of the causes of cancer?

13 What role does heredity play in cancer in the human being?

14 Is cancer infectious?

15 Does the cancer cell give off toxins?

16 What are the basic cellular disturbances in cancer?

17 What is the approximate proportion of the life span that passes between application of carcinogenic substances and the appearance of a recognizable lesion?

18 What is the role of tobacco, rough teeth, poor dental work and chronic irritation in cancer?

19 Oral lesions associated with tobacco and tobacco habits are frequently described Should the use of tobacco be discouraged on the above basis?

20 Should a patient with cancer of the oral cavity stop the use of tobacco and alcohol?

PART II

Diagnosis of Oral and Facial Cancer



Role of the Patient in a Cancer Program

AT THE CLINICAL level there are three important links in the cancer control program (1) the patient, (2) the family dentist or physician, who sees the patient first and makes the diagnosis and (3) the surgeon and radiotherapist who are called on to treat the patient. Intelligent co-operation of all three is essential or the program is destined to fail. The control of cancer is not a problem of the health professions alone- it is a problem of everyone.

Basically either the success or the failure of the control of cancer depends on the patient. An informed, intelligent, co-operative patient may become suspicious of cancer soon after its clinical appearance if he has knowledge of the early symptoms He may not be intelligent enough, however to seek proper advice early Many patients tend to procrastinate, seek advice of their friends or go to the "quack" who readily promises a great deal but unfortunately only delays proper treatment. During this early clinical stage, valuable time is lost while the cancer continues to grow

An important part of the educational program of the American Cancer Society for the lay public has emphasized the need for periodic medical examinations and early recognition and proper care of cancer Because of this extensive campaign a few neurotic individuals have developed cancerophobia. This however is not too great a price to pay if a greater number can be saved from death from cancer

Role of the Family Dentist and Physician in Cancer Control

IV

Diagnosis

PERIODIC MEDICAL and dental consultations are recommended by all of the health professions, and their necessity and value should be recognized by the public Many patients come initially to the dentist for advice in regard to the mouth A number of patients will consult their dentists when they become aware of lesions of the lip, buccal mucosa, tongue, floor of the mouth, hard palate and gingiva In addition, many more will visit the dentist for routine periodic dental examination and treatment Among these may be individuals with early signs of can cerous lesions of which they are unsuspecting, but for which the prognosis is most promising The dentist is the first to see the majority of cancer of the gingiva

If oral diagnosis is to be accurate, the technic of taking the patient's history and conducting the oral examination must be careful and complete It should pertain not only to the teeth alone but also to all of the oral tissues and associated structures Specific questions should be asked of patients suspected of having cancer (see Chap V) Particular areas, including the submandibular, submental and lower cervical regions should be subjected to careful examination (see Chap VII) In addition, special examinations are often essential to make a final diagnosis Roentgenograms of both the teeth and supporting bone, as well as of the jaws, aid in demonstrating the site and extent of destructive lesions Serologic tests are important in the diagnosis of syphilis, which may imitate cancer Most important, however, is the biopsy This requires the removal of a small, but not too small portion

of characteristic suspected tissue and its examination under the mi croscope. With this and the aforementioned procedures, a final diag nosis can be made (see Chap IX)

The following major headings are of value for oral diagnosis

I History (Chap V)
II. Physical examination (Chap VII)
III Summary
IV Tentative diagnosis
V Differential diagnosis (Chaps XI and XXX)
VI Special examinations (Chap IX)
VII Final diagnosis
VIII. Recommended treatment (Chaps. XXXI–XXXIII)

THE LIFE OF THE ORAL CANCER PATIENT IS IN THE HANDS OF THE FIRST DENTIST OR PHYSICIAN HE SEES

V

History

THE TAKING of a patient's history is an essential step in oral diagnosis It is an art and science which merits meticulous attention in every case Relevant and significant facts are often overlooked, forgotten or withheld by the patient unless they are drawn out by careful and systematic questioning The history outline shown in Figure 9 is quite extensive It is intended not for routine, everyday use by the experienced practitioner but rather as a guide and disciplinary exercise for the student who has not mastered the art

It behooves either the dentist or physician who first sees the patient with the complaint of a sore in the mouth or face to listen attentively, patiently and understandingly and to take sufficient time to question him systematically and thoroughly The following outline, adapted in part from one by Martin, includes questions which should be asked of a patient suspected of having cancer

1 What is the present complaint? Record the present complaint in the patient's own words

2 When did you first notice anything wrong or abnormal in regard to your present complaint? If the patient gives an indefinite answer, such as "about two months ago," determine the exact month, week and day if possible

3 What did you think it was? The answer may give you an insight into the patient's understanding of the problem.

4 What symptom or difficulty did you notice first and what other symptoms followed and when? Is the lesion growing larger? Does it ever tend to heal completely? It is important to ascertain the exact first symptom Some discretion may be used in recording the character and order of symptoms Some may be entirely irrelevant

5 What did you first think caused your trouble? The patient's opin-

Fig 9—Outline for Clinical History Taking.

A *Personal history*

1 Name (complete)
2 Address
3 Telephone number
4. Date
5 Age
6 Sex
7 Referred by
8 Marital status
9 Name and phone number of responsible member of family
10 Birthplace
11 Race
12. Nationality
13 Occupation

B *Present complaint and duration*
List symptoms in order of importance to patient, as (1) swollen jaw for three days (2) sore on tongue for one month etc.

C *Onset and course of present illness*
Patient s story of his illness, as Patient states that he was entirely well until April 18 1956 when he first noticed (describe symptoms in chronologic order) Include previous treatment for present illness

D *Past history*

1 Previous diseases Illnesses similar to present complaint. Illness etiologically related to present complaint, as childhood diseases. Other diseases according to patient s age at the time, as scarlet fever 4 years of age diphtheria, 8 years of age tonsilitis, chickenpox, rheumatic fever diabetes mellitus, arthritis, etc. Medication taken Diseases of adult life, including time of occurrence (also see family history)
2 Allergic conditions Hay fever asthma, sensitivity to drugs
3 Operations and anesthetics Include dental extractions, tonsillectomy blood transfusions and type of blood used, anesthetic agent used and complications if any
4 Accidents or injuries Type and date complications.
5 Habits Appetite sleep tobacco tea and coffee, drugs, alcohol
6 Menstruation.
7 Marital Pregnancies, miscarriages, children (age health deformities)
8 Former residence and travel.
9 Family history Family status father mother brothers, sisters, living or dead and if dead, age and cause of death Nervous or mental diseases, tuberculosis, cancer cardiovascular diseases, blood diseases, diabetes mellitus endocrine diseases

E *Inquiry by systems*

1 Head Headaches time of onset, duration, periodicity type of pain and location (frontal, occipital, lateral, superficial or deep)
2 Eyes Glasses, vision, inflammation, pain, diplopia, discharge edema of eyelids
3 Ears Loss of hearing, pain, noises (clicking, ringing, buzzing) discharge (type)

Fig 9 —Outline for Clinical History Taking (*cont*)

4 Sinuses Pain, swelling, discomfort, discharge

5 Nose Colds (frequency and severity), discharge, epistaxis, obstruction, congestion

6 Oral cavity (lips, cheeks, tongue, etc) Mouth-breather, dryness, excess salivation, ulcerations, odor, soreness, pain, bleeding, swellings, lip-biting, cleft lip

7 Teeth Pain, frequency of visits to dentist, loose teeth, previous extractions or surgery of mouth and complications, if any, fixed or partial prosthesis, "recurrence" of caries, calculus formation, bruxism, exfoliation of deciduous teeth, absent, abnormal or excessive teeth

8 Jaws Fractures, subluxation, dislocation, pain on opening or closing movement, tenderness, trismus, clicking noises

9. Palate and pharynx Cleft palate, ulcerations, sore throats, tonsilitis, hoarseness, dysphagia

10 Salivary glands Swellings in floor of mouth, ulcerations, salivation (activity and consistency), pain upon eating sour foods, salivary calculi, parotid, submandibular or submental swellings

11 Neck Pain, swellings or masses, rigidity

12 Cardiorespiratory Pain in chest, palpitation, swelling of feet, dyspnea on exertion, cyanosis, cough, sputum (amount and character), hemoptysis, night sweats, fever, hoarseness

13 Gastro-intestinal Appetite, nausea, vomiting, epigastric pain, diet, hematemesis, distention, constipation, diarrhea, blood in stool, loss of weight (lb and time)

14 Genitourinary Nocturia, hematuria, dysuria, frequency, urethral discharge, lumbar pain, venereal disease (when, how diagnosed, treatment)

15 Blood vascular Formation of hematomas, bruises, spontaneous bleeding from nose or mouth, weakness and fatigue

16 Bone and joints Fractures, arthritis, deformities, swelling and limitation of motion, rheumatism, pain

17 Neuromuscular. Headache, dizziness, fainting spells, paralysis, tremors, tics, paresthesia, anesthesia, trismus Pain regions involved (area and point of maximal intensity), time of onset relative to effort, chewing, change of body position, character (dull, sharp, throbbing, wavelike, radiation), duration, periodicity, medication for relief

18 Personality Introvert, extrovert, nervous irresponsible, compulsive

ion as to the cause of the growth is always of interest even though it may be illogical.

6 Have you seen anyone else in regard to this complaint? Include visits to family physicians, dentists, surgeons radiotherapists cultists and irregular practitioners Always record the names and addresses of all consulted in chronologic order If only the last name and street address can be obtained that information is nevertheless of great value.

7 What examinations were made? When? Record type of physical and blood examinations roentgenograms and whether a piece of tissue (biopsy) was taken. Record all dates.

8 What advice were you given by the examining doctor regarding the necessity for further examination and treatment? Did he tell you the name of your disease? The attitude of the first person consulted in regard to advice and treatment is an excellent indication of his tentative diagnosis

9 What did you do about it? This will indicate how concerned the patient is and how receptive he will be to treatment.

10 What treatment have you been given? When? Where? By whom? It is essential to record the method of examination and subsequent management of a cancer patient.

11 Who referred you?

The American Cancer Society and the United States Public Health Service have made certain recommendations for state cancer registration systems The objective is to obtain as complete accurate and up-to-date reporting on all cases of malignant neoplasms as practicable Several carefully prepared forms are used The record for malignant neoplasms shown in Figure 10 is designed for either the hospital or the tumor clinic. Further information concerning the state cancer registration system can be obtained from the American Cancer Society New York City

The obtaining of a written record of the patient's history has become axiomatic in the practice of medicine. It is equally important in oral diagnosis This is particularly true as advances are made in discovering the significance of changes in the teeth and oral mucosa as indicators of the health and disease of the individual, both past and present (6 23 24, 35 87) It may be difficult for the practitioner to accustom himself to this routine, and sometimes difficult for the patient to accept it. However a continuing process of education will no doubt result in both the doctor and the patient recognizing and appreciating the need for proper oral diagnosis

HOSPITAL OR TUMOR CLINIC RECORD OF MALIGNANT NEOPLASM

Please complete this form for every case of cancer, suspected cancer or other malignant tumor admitted for diagnosis or treatment Include Leukemia and Hodgkin's Disease Every case examined for suspected cancer should be reported whether or not the diagnosis of malignancy has been confirmed.

Hospital Case Number

Patient
1 Name
2 Address
3 County | 4 Date of admission for this condition

Nearest Relative or Friend
5 Name
6 Address

7 Date of Birth or Age | 8 Sex | 9 Race | 10 Marital Status

11 Referred to Hospital or Clinic by:

12 Method of Diagnosis Biopsy ☐ Clinical ☐ Other (Specify) ☐

13 Stage of disease at time of this diagnosis: Localized ☐ Regional Involvement ☐ Remote or Diffuse Metastases ☐ | 14 Date of This Diagnosis

15 *Type of Growth or Lesion* | 16 *Anatomical Site (Primary)* | 17 *Anatomical Sites (Metastatic)*

18 Has patient been treated previously for this condition? Yes ☐ No ☐
If yes, give name and address of physician or hospital | *Name* | *Address*

19 Present Status of Patient: Symptom free ☐ Ill but Ambulatory ☐ Ill in Bed ☐ Dead ☐

20 If Dead, Date of Death: | 21 If Alive, Prognosis: Good ☐ Fair ☐ Poor ☐

22 Patient Is Now at Home ☐ In This Hospital ☐ Other (Specify) ☐ | 23 Has this patient been told he has cancer? Yes ☐ No ☐

24 *Treatment (Check one or more): Surgery* ☐ *Radiation* ☐ *Other (Specify)* ☐

25 Purpose of Treatment Diagnostic Only ☐ Palliative Only ☐ Curative ☐

26 Is this a private patient? Yes ☐ No ☐ If yes, give name and address of physician | Name | Address

27 Hospital (Clinic) Submitting Report | Name | *Address*

28 Person Submitting This Report | Name (PLEASE TYPE OR PRINT) | Title | 29 Date of This Report

Fig. 10—Hospital or tumor clinic record of malignant neoplasm (Courtesy of American Cancer Society)

VI

Anatomic and Physiologic Considerations of the Oral Cavity and Face

The oral cavity marks the entrance to the alimentary canal. As the seat of the dental apparatus it serves to masticate the food and prepare it for digestion. It harbors the organs of taste and with the pharynx forms the resonator for speech. It also assists in respiration This function is abnormally accentuated in mouth breathing

External Anatomy

Externally the oral region is somewhat circumscribed by the nose above, the labiomental groove below and laterally by the nasolabial grooves The last extend down and laterally from the wings of the nose and pass a short distance from the corner of the mouth. The grooves or sulci tend to be more distinct in advanced age, during emaciation and among actors and others who because of their profession, take special care in enunciation

Normally the upper lip is slightly more forward than the lower Often the upper lip is short so that the gingiva is exposed during speaking

Internal Anatomy and Physiology

The oral cavity consists of the larger inner portion, the oral cavity proper and the smaller outer portion, the oral vestibule. The dental arches separate the two portions of the oral cavity (Fig 11)

Complete closure of the jaws with the teeth in occlusion permits little fluid to pass between the vestibule and the oral cavity proper except in the retromolar and interdental areas These spatial relation-

ships vary with function, as in breathing and speaking When the lips are closed and the jaws are at rest, the opposing teeth are not in occlusal contact (Fig 12) but are separated by an average of 3 mm The buccal and labial walls of the vestibule, however, are in contact

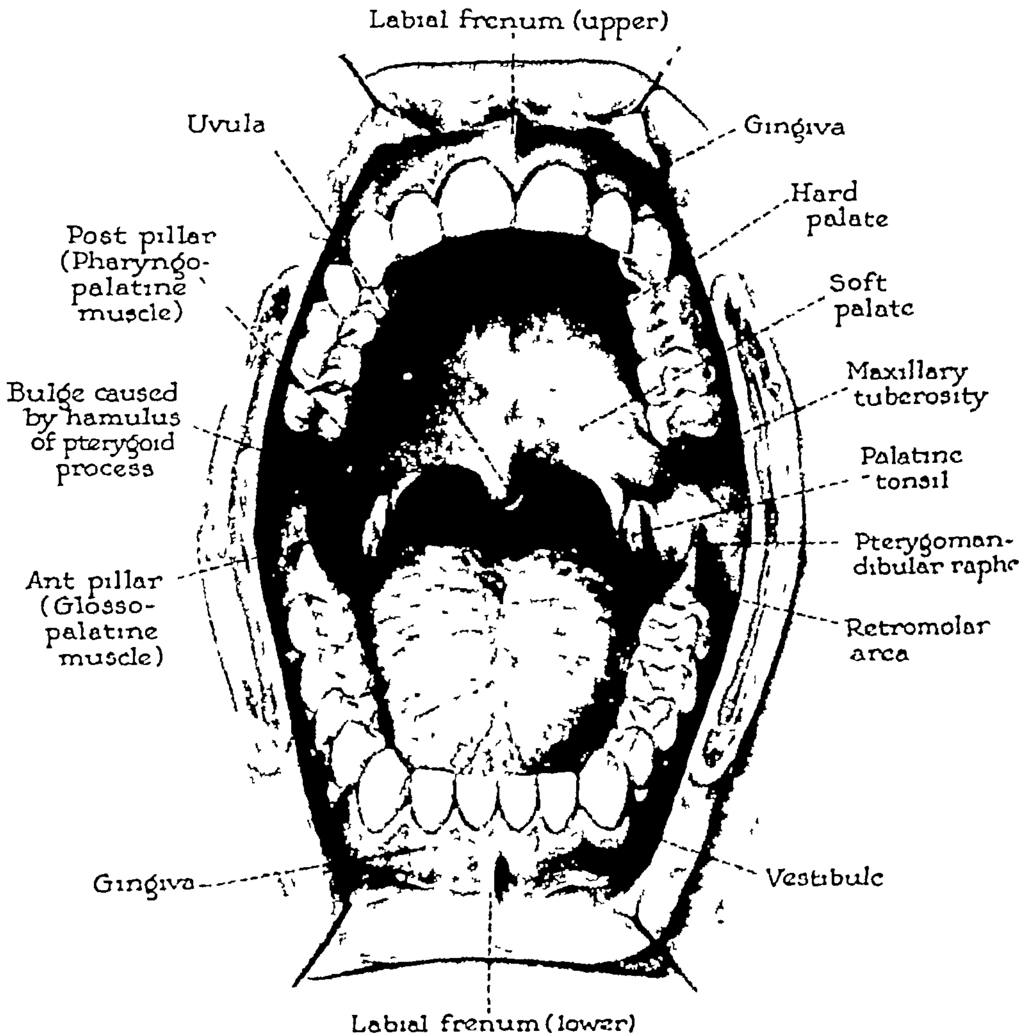


FIG 11 —The oral cavity (From Massler, M, and Schour, I *Atlas of the Mouth* [Chicago American Dental Association, 1948])

with the teeth and gingiva and form at best only a very narrow vertical slit The tongue practically fills the oral cavity proper except in its posterior portion, leaving only a slitlike space (Fig 12). Even when the mouth is open, it is a canal rather than a wide cavity The soft oral structures are in part movable and in part attached to the underlying structures

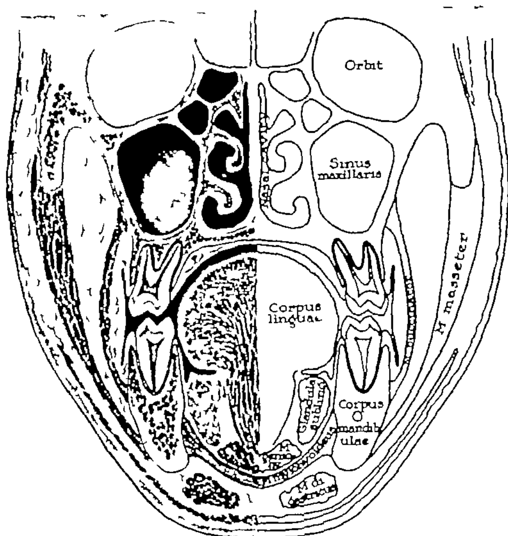


FIG. 12 —Frontal section through the face. (Modified from Massler M., and Schour I. *Atlas of the Mouth* [Chicago American Dental Association, 1948])

Oral mucosa —The oral mucosa is a warm and moist membrane which lines the oral cavity It consists of stratified squamous epithelium and the underlying connective tissue, the lamina propria and the tela submucosa. The latter is not present in the gingival areas where the lamina propria is attached to the immediately underlying periosteum. The oral mucosa is rich in minor salivary glands

While the rich blood and lymph supply permits ready and relatively rapid absorption, it also brings to the oral tissues systemic influences, whether they be physiologic or pathologic. Thus the soft tissues as

well as the alveolar bone, which are areas of stress, are especially vulnerable to nutritional and other systemic disturbances (6, 23, 21, 35, 87)

EPITHELIUM.—The epithelium is of the stratified squamous type Its layers are distinct The stratum germinativum consists of the basal layer of cylindrical cells and the middle layers of polyhedral cells The superficial cells are flattened and do not show cornification except where the mucosa is firmly attached and is subject to heavy mechanical stresses, as in the gingiva and hard palate Cells are continuously desquamated from the surface layers, especially during mastication, and are lost in the saliva

LAMINA PROPRIA.—The lamina propria supports and nourishes the overlying epithelium and projects into it by means of the connective tissue papillae The height of the papillae increases with the thickness of the epithelium Collagenous and elastic fibrillar bundles course through the lamina propria and increase in size in the deeper layers Similarly, blood and lymph vessels form a fine network in the lamina propria as they branch out from the larger vessels in the loose tela submucosa. The latter is loosely textured where the mucosa is quite movable against its base, as in the floor of the mouth, but may bind the mucous membrane tightly to the underlying structures, as on the hard palate and in the lips and cheeks The submucosa contains the mucous, serous and mixed glands and the ducts of the salivary glands

The cells of the connective tissue include fibroblasts, histiocytes and leukocytes The last often wander through the epithelium into the saliva, where they are found as the so-called salivary corpuscles.

COLOR.—The oral mucosa is a transparent red except for the more pink gingiva and the hard palate, in which the rich capillaries are not as readily seen because of the presence of the opaque corneated layer of the thicker epithelium The soft palate is yellowish

PIGMENTATION.—Occasionally melanin pigmentation of the lip and of the gingival epithelium is found close to the mucogingival junction This pigmentation is more common among Negroes than among Caucasians

ABSORPTION.—Absorption through the mucous membrane is very rapid, its noncorneated epithelium being much more permeable than the epithelium of the skin This fact is utilized in the topical administration for systemic action of drugs in the oral cavity, particularly in the region of the floor of the mouth and under the tongue

SENSITIVITY.—The oral mucosa is quite sensitive where it is not nor-

mally subjected to mechanical stress This is clinically demonstrated when artificial dentures extend beyond the alveolar ridges which are covered by a cornified layer to the less protected oral mucosa of the vestibule and floor of the mouth.

HEALING POWER.—Injuries to the gingiva and oral mucosa heal more rapidly than do similar injuries elsewhere The reason may be found in the high vascularity of these tissues, their rich lymph supply the bacteriostatic quality of the saliva and the special environment comparable to a moist chamber

The masticatory apparatus.—This is the group of structures and organs which subserve the function of mastication. Mastication is performed not by the isolated action of particular teeth or a particular jaw but by the combined activity and integration of the component parts as one unit.

The masticatory apparatus as a whole also functions in speech. However the teeth as such are not essential for this purpose since edentulous individuals can perform this function. The physiognomy which is man's most individual characteristic, depends largely on the form and contour of the masticatory apparatus

STRUCTURAL PLAN.—The masticatory apparatus consists of the teeth and their supporting structures (periodontal membrane and alveolar bone) the bodies of the maxillae and mandible the muscles salivary glands blood vessels and nerves

Although the alveolar process depends on the presence of the teeth the bodies of the mandible and maxillae grow and develop more or less independently of the teeth and their supporting structures They are not altered by the absence of teeth as in the case of total anodontia and loss following dental disease

The dentitions and jaws are articulated by means of the temporomandibular joint and the related musculomotor apparatus to maintain an efficient and harmonious occlusal and jaw relationship

The efficiency of the masticatory apparatus depends on the co-ordination of its various components Impaired function, absence or loss of any one of them may result in a breakdown of the entire apparatus The loss or removal of a single tooth may have far reaching sequelae especially in the case of premature loss of the deciduous molars or first permanent molars If the teeth are missing or in incorrect occlusion or if the jaws are in an abnormal relation, serious dysharmony in the masticatory apparatus will result.

THE TEETH.—The teeth must be properly arranged and organically

united with the rest of the body in order to perform their particular function in mastication The incisors cut the food and are situated in the anterior part of the mouth The cuspids seize and tear the food and are at the corner of the mouth. The bicuspids tear and grind and the molars comminute the food in the posterior region

These groups of teeth are arranged in arch form and the maxillary and mandibular arches or dentitions interdigitate and occlude so as to perform their functions most efficiently. The form of the tooth arch varies considerably with different individuals and is correlated with their cranial and facial form and body type Generally, there are three main types of arches· the square, the ovoid and the tapering Abnormal types of the arches present a major challenge to the orthodontist In any given individual the upper arch tends to follow an elliptical curve, while the lower arch is more parabolic.

PERIODONTAL STRUCTURES —The periodontal structures (gingiva, periodontal membrane, cementum and alveolar bone) hold the teeth in position and permit them to adjust microscopically to the continuous processes of tooth eruption and of occlusal stimulation (Fig. 13) Unlike enamel and dentin, which serve as permanent recorders of disturbances in mineral metabolism of the past, the continuously growing periodontal structures yield a transitory record of the present The supporting bone of the alveolar process is spongy and is therefore readily resorbed in calcium depletion Fortunately, the record of the alveolar bone is visible in intraoral roentgenograms and is therefore readily available for routine clinical examination.

The alveolar bone has a lower threshold to nutritional diseases than other bones because of the surrounding infection associated with gingivitis, the continued strain and stress of mastication and its more active growth and metabolism

DENTITION AND JAWS —During mastication a single dentoperiodontal unit (the unit consisting of the tooth and its supporting structures) can function only in conjunction with similar neighboring and opposing units The normal dentition thus consists of an integrated complement of such units properly alined and interdigitated Their co-ordination for the maintenance of functional equilibrium depends on the following types of adjustments and articulations (1) the movement of the teeth within their alveoli (alveolodental articulation), and (2) contact with adjacent teeth (contact articulation).

The teeth in each row or arch normally touch each other at the so-called contact points of their lateral or approximal surfaces These

contacts are usually situated at the level of either the occlusal or the incisal third of the crowns of the teeth. The embrasures or spaces below the contact points are filled by the interproximal gingival papillae

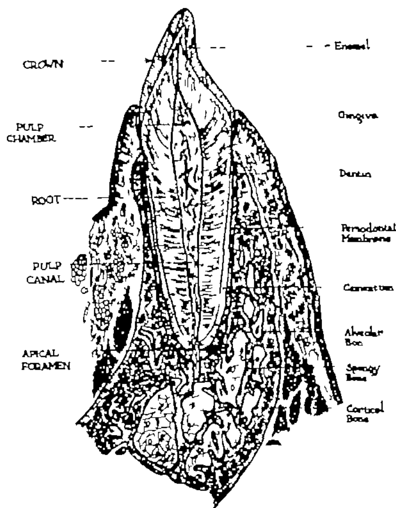


FIG 13.—The tooth and its supporting structures. (From Schour L [ed.]: *Noyes Oral Histology and Embryology* [Philadelphia Lea & Febiger 1953])

These contacts are at first points but become somewhat flattened planes with the interproximal wear associated with age

Occasionally a dentition is found in which the teeth, especially the anterior ones, are not in contact. Although such spacing may result in a reduction of the possibility of interproximal decay it offers the disadvantage of lacking esthetic appearance and of the frequent impaction of food

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DENTITION AND JAWS —During mastication a single dentoperiodontal unit (the unit consisting of the tooth and its supporting structures) can function only in conjunction with similar neighboring and opposing units. The normal dentition thus consists of an integrated complement of such units properly alined and interdigitated Their co-ordination for the maintenance of functional equilibrium depends on the following types of adjustments and articulations (1) the movement of the teeth within their alveoli (alveolodental articulation), and (2) contact with adjacent teeth (contact articulation)

The teeth in each row or arch normally touch each other at the so-called contact points of their lateral or approximal surfaces These

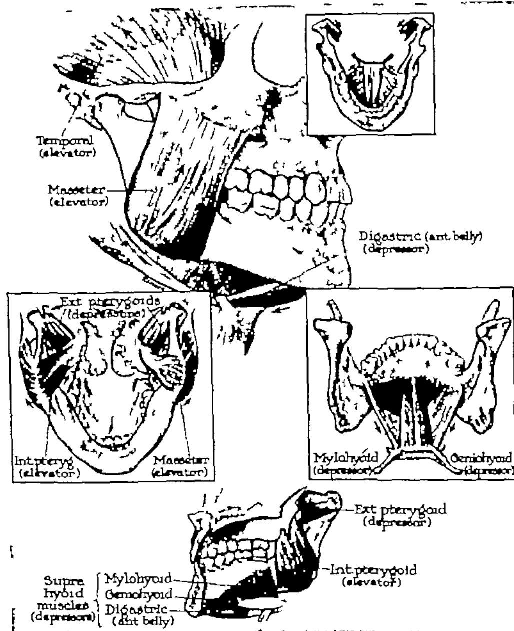


FIG. 15.—Muscles of the mandible. (From Massler M. and Schour I. *Atlas of the Mouth* [Chicago: American Dental Association, 1948])

rection A disturbance in any one of the foregoing interrelationships, as the loss of a single tooth, may and often will result in dysharmony and deformity and call for corrective measures by either the dentist or the orthodontist The harmony that normally characterizes the effective organization of the various units of the dentition results in an esthetic appearance

TEMPOROMANDIBULAR JOINT —This is the articulation between the temporal bone and the mandible (30) (Fig 14). Interposed between the temporal bone and the mandible is the third articulating body, the articular disk Because of the bilateral coupled articulation of a single bone, the movements of the mandible are restricted

The synovial capsule, the fibrous capsule and the accessory ligaments constitute the fibrous covering of the temporal and mandibular portion of the articulation The fibrous capsule is attached to the rim of the temporal articular surface and fuses with the articular disk around its borders, with the exception of the posterior margin, where the disk is loosely connected to the capsule It continues downward to the mandibular condyle and includes a portion of the neck of the mandible The synovial capsule follows the fibrous capsule closely and ends along the entire circumference of the disk On the lateral surface of the joint it is reinforced by the temporomandibular ligament Although the fibrous capsule is loose between the temporal bone and the articular disk, it is considerably tighter between the disk and the mandibular condyle The sphenomandibular and stylomandibular ligaments are described as the accessory ligaments of the temporomandibular joint They are not important to movements of the mandible

Movements of the mandible and the temporomandibular articulation depend on the correlated action of the mandibular musculature, namely, the elevators (masseter, temporal, internal pterygoid) that also have retrusive components, the protrusor, external pterygoid, and the depressor-retractors, digastric and geniohyoids Two particular positions of the mandible should be clearly understood the occlusal position, and the rest position In the occlusal position the teeth of the mandible and the teeth of the maxilla are in full contact This position is kept stable by the interlocking of the cusps of the teeth and the contraction of the masticatory muscles Actually, however, the jaws are seldom in this position The more common position is one in which the upper and lower teeth are not in contact and an opening of 2–4 mm between the incisal edges of the teeth exists This position depends not on the presence of teeth but only on the muscular tonus

VII

Complete Oral and Facial Examination

THE SYSTEMATIC examination of the oral cavity as part of physical diag nosis has been a neglected phase in medical and dental practice (Fig 16) Of the various cavities of the body the mouth is readily accessible and the easiest to examine and often yields significant information It permits a gross and detailed view of a mucous membrane without special instrumentation or approach At the same time, it contains a number of different structures which are influenced characteristically by local and systemic disease

Enamel and dentin give a permanent and chronologic record of systemic influences of the past (enamel hypoplasia) The gingiva and oral mucosa on the other hand, reflect metabolic disturbances of the present (blood dyscrasias, nutritional deficiencies) Local environmental factors of the present are reflected both in enamel and dentin (caries erosion, bruxism, occupation, etc.) and in the gingiva and oral mucosa (neglect in oral hygiene) (6 23 24, 35 87)

Since the oral cavity is continuously exposed to the forces of masti cation and the chemical and physical irritation of the food it reflects various subclinical states (infection nutritional deficiency) early and readily Thus the family dentist and physician have an opportunity to practice preventive and protective dentistry and medicine by finding early lesions of which the patient may not be aware.

If obscure lesions are to be noted, the technic of oral and facial examination must be exacting and must include more than an examina tion of the teeth (Figs 16–22) Too frequently the oral examination by the dentist consists only of an inspection of the physical aspect of the teeth, their mutual relation and the occlusion of the dental arches. The physician also at times tends to perform a cursory examination of the oral cavity In either event there is failure to recognize and to diagnose

The action of the muscles on the articulated jaws creates the func-
onal dental apparatus (Fig 15) The salivary glands, nerves, blood
essels and soft tissues are naturally an integral part

Teeth and Cancer

The fully formed enamel and dentin do not present any problem in
e field of oral cancer The enamel in its completed form is avascular
nd acellular Its apposition has stopped in the early developmental
ages, and it has no power of regeneration Dentin, similarly, is not
pable of tumorous growth These facts are in harmony with the gen-
al rule that the tissues with less regenerative powei are less likely to
evelop tumors Cancer has been found in the human dental pulp in a
w instances In each case, however, the malignant growth represented
metastatic spread through the pulpal blood vessels from a primary
urce in another part of the body (57)

TO RECOGNIZE THE ABNORMAL,
ONE MUST KNOW THE NORMAL

Fig 16.—Outline Used as Guide for Physical Examination (*cont*)

9 Salivary glands Swelling, tenderness, activity viscosity of secretions of the sublingual submandibular parotid.

10 Lips Skin and mucous membrane surfaces and commissure ulcers, pits, clefts, fissure edema, anesthesia, frenum, bullous lesions, swellings cheilitis

11 Mouth Odor size (microstomia, macrostomia) trismus, foaming, distortion, salivation (excessive dry mouth)

12. Buccal mucous membrane Ulceration, sebaceous glands, vestibular attachment, papilla of parotid duct (swelling, redness) bullous lesions, whitish lesions, pigmentation

13 Tongue Examine all surfaces dorsal, anterior and posterior inferior ulcerations, immobility tremor color tenderness, fissure scars, deviation, swelling, smoothness, coating, frenum.

14 Floor of the mouth Ulcerations, swelling, submandibular duct (swelling, redness)

15 Hard and soft palate Cleft, ulceration, perforation, scars, texture, swelling, deformity uvula (bifid, deviation) inflammation, paralysis.

16 Pharynx Ulceration, masses, fissures, injection, exudate and surface change

17 Tonsils and tonsillar pillars Size and position, crypts, injection, ulceration.

18 Gingiva and retromolar area (alveolar and areolar) Ulceration, color texture, bleeding, consistency hyperplasia, atrophy depth of gingival crevices.

19 Teeth Status of dental development, number present, condition (caries and repair) erosion, hypoplasia, peg shaped laterals, mulberry molars contact relationship position in the arch, mobility tenderness on percussion, vitality of pulp dentin sensitivity hygiene prosthesis (removable fixed)

Fig 16 —Outline Used as Guide for Physical Examination

A Temperature (oral, rectal) Weight (with or without clothes)
Pulse Height (bare feet)
Respiration Blood pressure (patient sitting or reclining)

B Introductory remark such as Physical examination reveals a well developed and nourished white female sitting in bed, who appears to be about 35 years of age, in no acute distress, etc

C *Regional examination*

1 Head General shape, symmetry, hair (color, amount, texture), scalp, ulcerations, contusions, lacerations, tumors

2 Face Symmetry, expression, lacerations, skin color and texture, moisture, eruptions, scaling, pigmentation, paralysis, draining sinuses, anesthesia, edema, ulcerations

3 Neck Movement, lymph nodes (palpability, size, tenderness, pain, consistency, mobility, swelling of submandibular, sublingual, cervical, sternoclavicular), thyroid gland (size, consistency, pulsation)

4 Eyes Vision, lids (ptosis), exophthalmos, brows, external ocular movements, edema, reaction to light and accommodation, diplopia, subconjunctival hemorrhage

5 Nose Smell, obstruction, discharge, septum deflection, ulceration, perforation, deformity

6 Ears Hearing, mastoid tenderness, discharge (blood, clear fluid), position, malformation, ulcers

7 Temporomandibular joint Ankylosis, subluxation, dislocation, pain, tenderness, ear symptoms, overclosure, displacement

8 Jaws Symmetry, prognathism, underdevelopment, swelling, pain, tenderness, trismus, mobility of fragments, crepitation, malocclusion, relative position of ridges

Fig. 16 —Outline Used as Guide for Physical Examination (*cont*)

9 Salivary glands Swelling, tenderness, activity viscosity of secretions of the sublingual, submandibular parotid
10 Lips Skin and mucous membrane surfaces and commissure, ulcers, pits, clefts, fissure edema, anesthesia, frenum, bullous lesions, swellings, cheilitis
11 Mouth Odor size (microstomia, macrostomia) trismus, foaming distortion, salivation (excessive, dry mouth)
12. Buccal mucous membrane Ulceration, sebaceous glands, vestibular attachment, papilla of parotid duct (swelling, redness) bullous lesions, whitish lesions, pigmentation.
13 Tongue Examine all surfaces dorsal, anterior and posterior inferior ulcerations, immobility tremor color tenderness, fissure, scars, deviation, swelling, smoothness, coating, frenum.
14. Floor of the mouth Ulcerations, swelling submandibular duct (swelling, redness)
15 Hard and soft palate Cleft, ulceration perforation, scars, texture, swelling deformity uvula (bifid, deviation) inflammation, paralysis
16 Pharynx Ulceration, masses, fissures, injection, exudate and surface change
17 Tonsils and tonsillar pillars Size and position, crypts, injection, ulceration.
18 Gingiva and retromolar area (alveolar and areolar) Ulceration, color texture, bleeding, consistency hyperplasia, atrophy depth of gingival crevices.
19 Teeth Status of dental development, number present, condition (caries and repair) erosion, hypoplasia, peg shaped laterals, mulberry molars, contact relationship position in the arch, mobility tenderness on percussion, vitality of pulp dentin sensitivity hygiene prosthesis (removable fixed)

the early signs and symptoms not only of cancer but of other conditions A method of complete examination should be established that can be followed and can be developed into a habit

To perform an oral examination properly, one must be familiar with the appearance of normal tissues Once this has been mastered, little difficulty should be encountered in recognizing the abnormal

The oral cavity and face lend themselves readily to inspection (Figs. 17–22) and palpation In some cases, percussion and even auscultation may be employed

Inspection

This requires adequate light for both extraoral and particularly intraoral visualization A head light or head mirror is often of great help The actual examination begins as the patient walks into the office and sits in the chair The discerning examiner recognizes abnormal conditions of the face, lips and neck at a glance (Fig 17) Cosmetics should be removed for examination of the skin of the face and lips Examination of the teeth alone is neither an adequate nor a complete oral examination The examination should be thorough and complete, with detailed records of the findings, and should proceed systematically, preferably in the following order

A Extraoral examination
  1 Face
  2 Parotid and submandibular salivary glands
  3 Submandibular and submental lymph nodes
  4 Jaws and temporomandibular joints
  5 Neck and cervical lymph nodes
  6 Lips and corners of mouth

B Intraoral examination
  1 Mucous membrane of lips and cheeks and papillae of parotid ducts
  2 Floor of mouth, sublingual gland and submandibular duct
  3 Tongue (all surfaces)
  4 Palate (hard and soft)
  5 Tonsils and tonsillar pillars
  6 Posterior pharyngeal wall
  7. Retromolar area
  8 Gingiva and alveolar bone (periodontal pockets, interdental areas)
  9 Teeth

The order of examination is arranged so that the extraoral structures are examined first, the anterior intraoral structures next and the posterior oral and pharyngeal structures last This sequence also permits

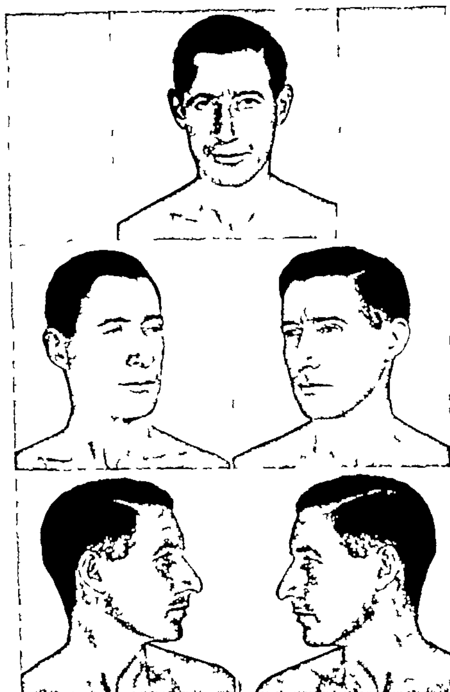


FIG 17.—Inspection of head, neck and face. The patient should be inspected from the frontal to lateral views for ulcerations and pigmentation of the skin, swellings asymmetry pulsations and difficult or abnormal opening of the mouth. During the facial examination, the vermilion zone and mucosal surfaces of the lips should be carefully examined.

the patient to become accustomed to the examination so that he will be better able to co-operate for the more difficult oropharyngeal part of the examination.

The teeth are deliberately placed last in the order of examination because, of all the oral structures, the dentist is least likely to neglect them However, it may be found to be more practical to examine the dental structures first During the systematic oral examination, unsuspected cancer may be detected earlier and more readily than cancer of the rest of the gastrointestinal tract and of other viscera, where special instruments or technics are required

Palpation

Palpation in a complete oral examination is of great value in diagnosis. It should be done gently, nevertheless thoroughly. Rough handling of malignant tumors may hasten the cellular spread It must be pointed out that the examiner's hand should be gloved for palpating unknown lesions. Usually the mass can be palpated best between the thumb and index finger

Extraoral palpation is extremely important in attempting to determine whether oral carcinoma has spread to the submental, submandibular or cervical lymph nodes (Fig 18) In examination of the regional submental and submandibular lymph nodes, extraoral palpation alone may sometimes fail to reveal any changes However, if extraoral palpation is combined with the placing of the index finger of the opposite hand along the floor of the mouth to fix the mylohyoid muscle, a lymph node that is only slightly enlarged may be readily palpated. This examination can be further aided by positioning the patient's head forward, downward and laterally In this way the skin and fascia are relaxed over the area to be examined (Fig 18)

When a definite intraoral lesion is present, palpation yields information as to its consistency, sensitivity, extension or infiltration and its relation to adjacent structures Carcinoma in an advanced state is firm and fixed to the underlying structures

When palpation reveals loose teeth, it is important to determine the cause of this loosening, especially when it is limited to a single tooth This may be the first sign of cancer in the region of the tooth

Percussion and auscultation are not as important in oral examination as in the examination of the chest However, percussion of teeth reveals the normal and abnormal behavior of the periodontal membrane

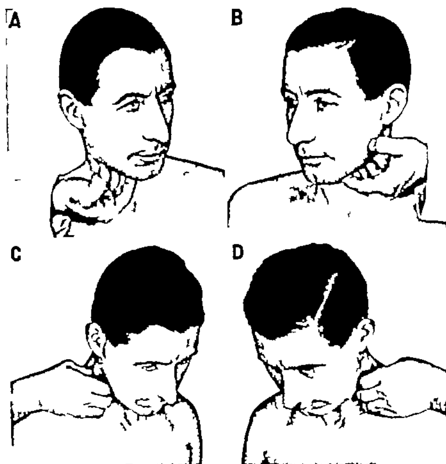


FIG. 18—Palpation. This important step in physical diagnosis should follow inspection Palpation of submental, submandibular (*A* and *B*) and cervical (*C* and *D*) regions for firm, fixed swellings frequently will disclose the spread of oral or facial cancer

Auscultation can be used to detect disorders of the temporomandibular joint and to establish whether certain oral or cervical masses might be aneurysms

EXAMINATION OF SWELLINGS

The examiner primarily by inspection and palpation should obtain the following information if the patient has a swelling

1 *Site* —Determine the exact location of the swelling, especially its depth and its relationship to adjacent structures

2 *Size and shape* —If possible, the size and shape should be meas ured accurately by a millimeter or centimeter ruler This should in

clude not only the surface area but some approximation of the depth In addition, a sketch is often valuable

3 *Surface*—If the surface is ulcerated, a description of the border (regular or irregular, smooth, rolled, raised, thin) should be included

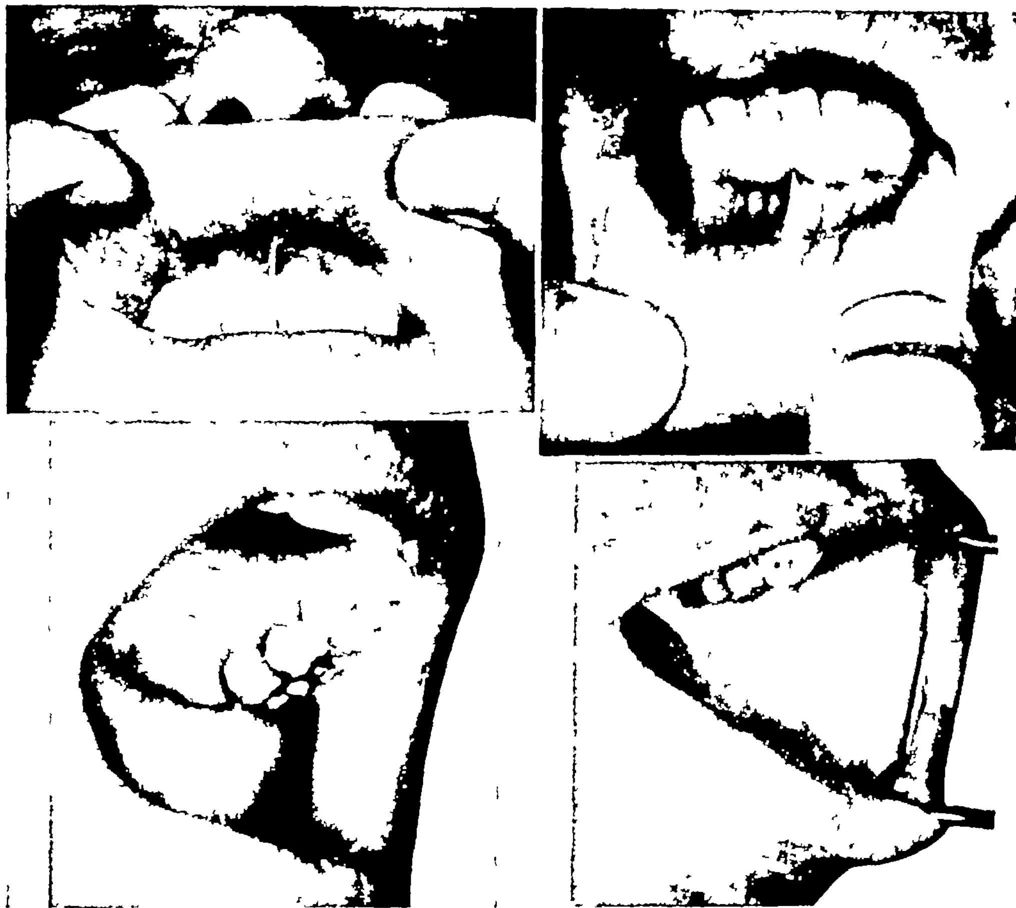


FIG 19—The oral cavity Structures readily visible on inspection are the upper and lower lips, corners of the mouth, labial frenum, buccal mucosa, opening of the parotid duct, gingiva and teeth

The raw area should be described in regard to color, bleeding and presence of a membrane which can or cannot be removed readily The surface of nonulcerated swellings also should be described in terms of its color and contour

4 *Consistency*—The consistency of a mass is determined by palpation *This is a most important part of the clinical examination* Cancer (unless it has undergone cystic degeneration) is almost stony hard This is quite distinct from the benign tumors of soft tissues and the

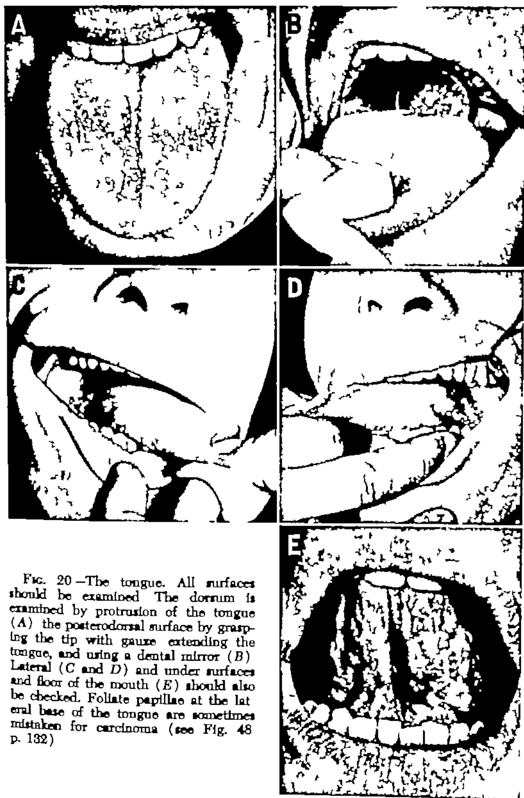


FIG. 20—The tongue. All surfaces should be examined. The dorsum is examined by protrusion of the tongue (*A*), the posterodorsal surface by grasping the tip with gauze, extending the tongue, and using a dental mirror (*B*). Lateral (*C* and *D*) and under surfaces and floor of the mouth (*E*) should also be checked. Foliate papillae at the lateral base of the tongue are sometimes mistaken for carcinoma (see Fig. 48, p. 132).

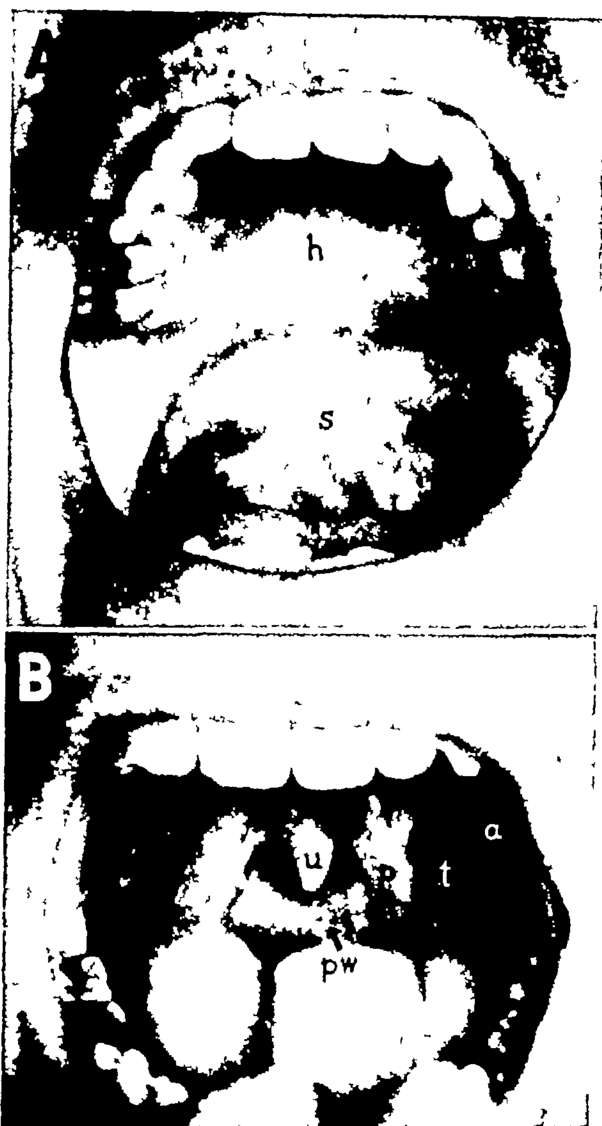


FIG 21 —*A*, palate, *B*, oral pharynx *a*, anterior tonsillar pillar, *h*, hard palate, *p*, posterior tonsillar pillar, *pw*, posterior pharyngeal wall, *s*, soft palate, *t*, tonsil *u*, uvula

fluctuant masses containing fluid It must be pointed out that benign tumors of bone, because of their hardness, cannot be differentiated from cancer by palpation The consistency can be best determined by feeling the lesion between the thumb and index finger

5 *Fixation* —Benign tumors are encapsulated and do not infiltrate into the surrounding tissue Consequently they are readily movable Malignant growths, on the other hand, may eventually be fixed to the surrounding tissue, sometimes to the skin, and therefore are not moved

readily or move with the overlying skin This is a result of the infiltration by the cancer into the adjoining tissues

6. *Secondary invasion of lymph nodes*.—Discovery of either an oral or facial lesion requires careful examination of the neck. The cervical lymph nodes usually react to either inflammation or neoplasm in the



FIG. 22.—Fauces *a* anterior tonsillar pillar *p* posterior tonsillar pillar *t* tonsil *u*, uvula.

mouth or face If the reaction is due to inflammation, the cervical nodes are enlarged and may be tender soft to firm and not fixed. The findings vary depending on whether the inflammation is acute or chronic. If the reaction is due to cancer the cervical lymph nodes are not tender but are enlarged and firm In the early stages the lymph nodes may be movable later they are fixed to the surrounding tissues.

SUMMARY

If the conditions are normal, the aforementioned procedures will require but a few minutes. Therefore the clinical and roentgenographic examinations of patients by the dentist, in many instances long before

they present themselves for medical examination by a physician, permit him to aid in the early recognition and diagnosis of cancer, particularly primary cancer of the mouth and face On the other hand, many patients present themselves for dental treatment with advanced stages of cancer that had not been recognized earlier

SEARCH FOR THE ABNORMAL

VIII

Clinical Signs and Symptoms of Oral and Facial Cancer

The importance of early recognition of a cancerous process in the mouth or face makes it necessary that the examiner be well informed regarding the early signs and symptoms (Fig 23) The insidious onset and the silent (asymptomatic) early course must be repeatedly emphasized. Vigilance and conscientious care in the routine examination of the face, mouth and pharynx are therefore imperative.

In conducting an oral and facial examination both the dentist and physician must recognize the early and late signs and symptoms of both primary and secondary cancer The idea should be abandoned that certain characteristic clinical signs are always essential for the diagnosis of malignancy Instead, a definite and standard approach must be developed for the management of every suspicious area which differs from the normal in order to root out the early cancers

Pain, loosening of teeth, paresthesias and roentgenographic changes having no discernible local etiologic factors must be considered as possible symptoms of cancer metastasizing from another part of the body This is particularly true if there is a history of recent and continuous loss of weight, pain, bleeding or tumor like masses in other parts of the body Of course, these are far advanced cases

Tumor

A tumor may be defined as a swelling or mass This could be caused by trauma, inflammation or new growths The term "tumor" however is usually limited to new growths New growths may be benign. These are limited in growth, do not metastasize and usually do not cause

ally fixed to the underlying structures because it infiltrates. It has a firm consistency if palpated between the fingers. When the mass outgrows its blood supply, the central part undergoes necrosis and becomes soft and ulcerated (Fig 25). A red, raw, granular surface is

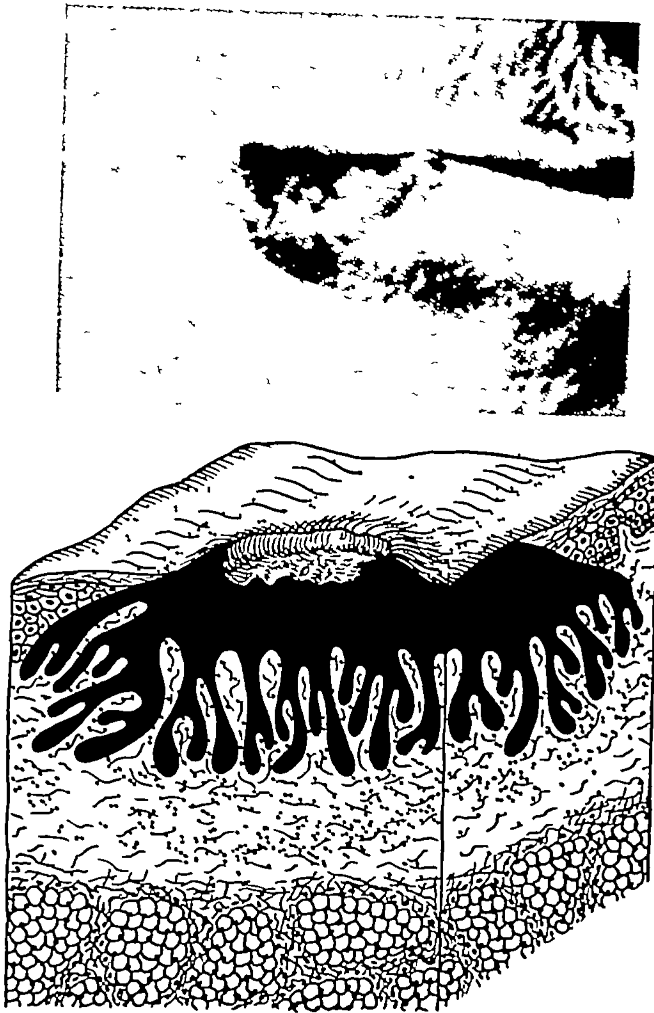


Fig 25—Carcinoma of the lip *Above,* advanced clinical stage The ulcerated mass is large (compare with Fig 24), fixed to underlying tissue, infected and centrally necrotic *Below,* spread of the carcinoma into surrounding normal tissue

present which bleeds easily The surface soon becomes secondarily infected With infection and necrosis of tissue, the surface may take on a gray coloration A foul odor may develop The lesion may become painful and tender to the touch. Chewing, drinking and talking may be distressing

Classification of carcinoma—Generally carcinoma can be classified

according to the principal direction of growth into two groups (1) exophytic, and (2) endophytic.

The exophytic type of carcinoma (Fig 26 *A*) although it does in filtrate and proliferate inward is characterized primarily by a promi nent fungating growth, the surface of which soon becomes ulcerated and secondarily infected. This type of carcinoma is described as out growing, one growing toward the examiner and away from the patient. It is usually of a relatively low degree of malignancy and its tendency to distant spread is not high

The endophytic type of carcinoma (Fig 26 *B*) although it does grow outward to a small extent, is characterized primarily by a rela



Fig 26.—Exophytic and endophytic types of carcinoma of the lip *A*, exophytic type, present at least three years. It is slow in growth and of low grade malignancy The bulk of growth is external to the lip *B* endophytic type, present not more than six weks. It is relatively rapid in growth, invasive and of higher grade malig nancy The bulk of growth is within the lip.

tively smaller sharply punched-out ulcerative superficial area with in filtration of the tumor into the depth This type of carcinoma is de scribed as ingrowing, one growing away from the examiner and toward the patient. This smaller and less spectacular looking tumor is usually of a higher degree of malignancy than the exophytic type and conse quently does not have as favorable a prognosis

Sarcoma—Sarcomas usually arise in, or are closely associated with, the jaws They may cause enlargement of the bone. Proliferation of bone occurs in the osteogenic sarcoma. Consequently when palpated, they are very hard and fixed. In the early stages when no clinical signs may be apparent, roentgenograms may be of value. Eventually swell ing and deformity of the face become apparent. The rate of growth is frequently quite rapid.

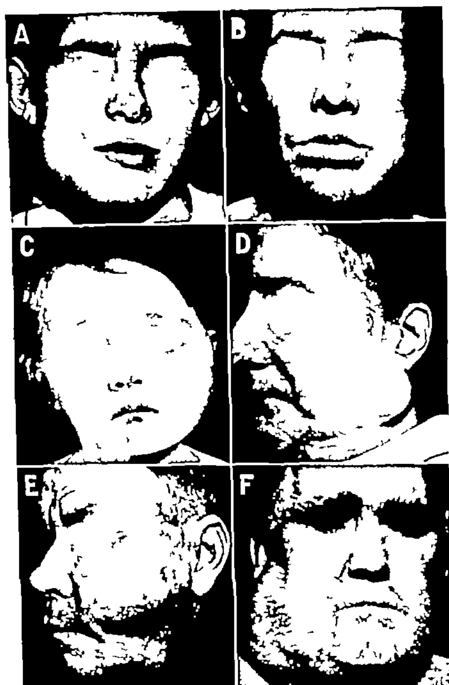


Fig 27 —Differential diagnosis of swellings of the face *A*, acute facial abscess of dental origin. *B* actinomycosis, a chronic infection. *C* lipoma, a benign fatty tumor which, because more radiolucent than normal tissue can be diagnosed by roentgenogram *D* mixed tumor of parotid gland, it grows slowly may be present for many years and may become malignant. *E* squamous cell carcinoma of the cheek, highly malignant. *F* adenocarcinoma of parotid gland, highly malignant.

into the neck (Fig 32, *E*, p 99) Sometimes the first sign of an oral or facial carcinoma is a hard, fixed swelling in the submental, submandibular or cervical region (Figs 52, p 135, 67, p 159, and Table 5, p 94) A patient with such a swelling must have a complete examination of the oral cavity, the entire pharynx, the maxillary sinuses and the face so that the primary site of growth can be located An expert in the examination of the hypopharynx and nasopharynx should be responsible for this part of the procedure If the primary lesion is not found, thorough examinations should be repeated every two weeks The primary lesion, although quite small and apparently innocent looking on gross examination, may actually be highly malignant

Submandibular and cervical metastases are most frequently a result of spread from a malignancy above the clavicles It must be pointed out, however, that a mass in the cervical, submandibular or parotid area may relate to a cancer inferior to the clavicles (Table 6, p 98)

Primary swellings of the neck do occur, but as a rule they are not malignant (Fig. 32, *A*, *B*, *D*, p 99) Primary carcinoma of the neck, other than that of thyroid gland, is uncommon Malignant transformation of a lateral cervical cyst (branchial cleft cyst) is also uncommon

Loose Teeth

The alveolar bone is connected to the cementum of the tooth by the periodontal membrane (Fig 13) Consequently, the destruction of the alveolar bone for any reason will result in the loosening and separation of the teeth in the affected area

One must always think of cancer of the jaw if teeth in a restricted area are loose and there is no particular gingival or periodontal involvement Tumors often invade the jaws either directly or by metastasis and may destroy both the attachment apparatus of the teeth and the bone As a result, the teeth become loose (Figs 23 and 78, *A*, p 184) If cancer is the known cause of loose teeth, the teeth should not be extracted without first consulting the specialist who will treat or is treating the cancer Extraction of these teeth may only increase the spread of the cancer

If a growth is found in the base of a wound either at the time of or after dental extraction, do not discard the tissue It may be cancerous and should be examined microscopically (Fig 78)

Pain (Local, Referred)

The association of pain with oral cancer indicates that the growth is probably fairly well advanced. Pain is not an early complaint unless the cancer is located in an area of motion or is subjected to trauma Unfortunately many patients will not seek aid until pain is present. The pain results from either secondary infection or pressure Carcinoma without infection is usually painless

Secondary infection.—Because of moisture maceration oral trauma and oral bacterial flora, secondary infection of cancer tends to occur earlier in the oral cavity than in cancer elsewhere With the secondary infection all of the cardinal symptoms of inflammation, of which pain is one may be present. If the infection is eliminated, the pain from this cause will disappear

Pressure.—A second cause of pain in carcinoma may be pressure on the pain fibers of sensory nerves The distribution of the pain depends in part on the site of pressure However the pain may be referred The patient complaining of pain around the face and jaws should be suspected of having cancer The patient should not be dismissed with a diagnosis of trigeminal neuralgia until a thorough examination has been made. Sometimes after a period of severe pain the patient states that the pain has disappeared but that numbness is present In such an instance the tumor probably destroyed the nerve completely

It must be pointed out however that pain in the oral cavity may be referred from some extraoral source Patients with cardiospasm and epigastric pain may complain of pain in the lower jaw neck and ears. Other conditions such as nasopharyngeal tumors and intracranial lesions must be considered as possible causes of pain in the differential diagnosis Associated with the pain may be other signs and symptoms such as deafness and asymmetry of the palate

Paresthesia and Anesthesia

Patients with oral carcinoma sometimes complain of tingling or a sensation of numbness along the side of the jaw or face This is caused by the pressure of the tumor on the various branches of the sensory divisions of the trigeminal nerve Central tumors of the mandible and carcinoma of the maxillary sinus are the more common causes.

Paralysis

Facial weakness or palsy is frequently associated with carcinoma of the parotid gland. The tumor encroaches on the facial nerve and either decreases or eliminates the conductivity of the nerve impulse to all or a portion of the facial muscles. It seldom occurs with mixed tumors of the parotid gland. Bell's palsy and paralyses of central origin must be differentiated.

Paralysis of one half of the tongue with atrophy and deviation to the affected side may follow pressure on the hypoglossal nerve. Such pressure may come from a carcinoma of the lateral wall of the nasopharynx or as a result of an intracranial lesion.

Compression of the motor fibers of the mandibular branch of the trigeminal nerve results in paralysis of the external and internal pterygoid, masseter and temporal muscles. The soft palate is also affected (tensor palati muscle).

Trismus

Inability to open the mouth can be caused by cancer or the secondary infection related to it. The area involved is around the ramus of the mandible, the masseter, the internal pterygoid and temporal muscles. Trismus may be one of the earliest symptoms of a nasopharyngeal tumor which has extended laterally.

Difficulty in Swallowing

Swallowing is difficult when the tonsillar pillars, pharyngeal walls, palate, tongue and floor of the mouth are involved. Pain, fixation of structures and obstruction are the immediate causes of the difficulty.

Bad Breath, Poor Oral Hygiene, Increased Salivation

A foul and characteristic odor develops after an oral growth becomes necrotic and secondarily infected. Furthermore, because of the associated pain, the patient tends to neglect his oral hygiene. Food and its products of degradation collect around the teeth, contributing further to the bad breath. Associated with this is increased salivation.

Poor Speech

Speech may become defective if the tongue has been fixed or infiltrated by the cancer or if a large growth is filling the oral cavity

(Figs. 56 p 140 and 64, p 154) Speech is disturbed also when the palate, nasal cavity maxillary sinus or oral cavity has been perforated (Fig. 116 p 253)

Hemorrhage

The surface of the cancer may bleed because of trauma, but this is not usually of great import. In far advanced carcinoma, infection and necrosis or invasion of a blood vessel of major size may result in a fatal hemorrhage.

REMEMBER THAT EVEN EARLY CLINICAL SIGNS AND SYMPTOMS ARE LATE IN THE PATHOGENESIS OF CANCER

IX

Laboratory Aids

IN ADDITION to the history and physical examination, the following laboratory procedures facilitate the making of a proper diagnosis

SPECIAL EXAMINATIONS

A Blood tests complete blood count, differential cell count, bleeding time, clotting time, hemoglobin, prothrombin time, Wassermann and Kahn agglutination
B Roentgenograms intraoral, occlusal, extraoral, lateral view head plates, posteroanterior view head plates, nasal sinuses, temporomandibular joint, zygoma, skull, long bones, pelvis, laminagrams
C Biopsy
D Bacteriologic tests
E Urinalysis
F Study models
G Photographs

ROENTGENOGRAPHIC AND SEROLOGIC EXAMINATIONS

Roentgenographic examination —This is indispensable to a complete oral and facial examination The roentgenograms must be adequate in extent, technic and interpretation No attempt should be made to base a diagnosis on unsatisfactory films If the intraoral x-ray examination reveals changes which require further analysis (Fig 78, *A*, p 184), larger intraoral (Fig 78, *B*) and extraoral films should be taken X-ray examination for jaw lesions should include posteroanterior (Fig 78, *C*) and lateral (Figs 79, p 187, and 80, p 188) films One should not hesitate to have the professional roentgenologist, either dental or medical, take additional views

X-ray films can be of great aid in the diagnosis of cancer Although one must rely on the microscopic study of the tumor tissue for the

final diagnosis the roentgenogram will disclose the site of the tumor and to some extent the amount of bone destruction (51 52) Unfortunately the roentgenogram gives us only a gross view of what has occurred One may not be able to diagnose a destructive lesion on the basis of a roentgenogram if the process is not advanced far enough Furthermore the amount of destruction is probably more extensive than the roentgenogram reveals

The roentgenogram is valuable in detecting bone tumors of primary and secondary origin These include sarcoma, carcinoma with local spread (maxillary sinus lip cheek, gingiva, floor of mouth, tongue palate) and cancer which spreads to the jaws from distant sites

Serologic examination.—Every patient suspected of having cancer should have either a Wassermann or a Kahn blood test. Syphilitic lesions may be mistaken for cancer and patients with cancer may have, in addition syphilis. A positive serologic reaction does not mean that biopsy of a suspected neoplasm should not be done Valuable time will be lost by treating a patient for a syphilitic lesion which in reality is cancer Carcinoma of the tongue is common in patients with syphilitic glossitis. Chemical examination of the blood serum is also of value because certain tumors present in bone may cause elevation of the serum phosphatase values

Histopathologic Aspects

Biopsy and tissue preparation.—The most important step in the final diagnosis of cancer is the microscopic examination by a qualified pathologist of a properly prepared and representative section of the suspected tissue When a patient is seen with a far advanced carcinoma, the clinical diagnosis can be made with a high degree of certainty The biopsy confirms the diagnosis and treatment may only be palliative. However since the challenge and aim are to detect cancer at its earliest clinical stage, the biopsy is of the utmost importance Many times the clinical diagnosis is doubtful and biopsy of the early small lesion (which even may mean its complete removal) will give us the final diagnosis (Fig 28) A diagnosis of cancer cannot be regarded as certain if based only on a clinical history physical examination and roentgenographic study

In the case of a lesion suspected of being cancer it is probably best that the biopsy be taken by the one who is ready to proceed immediately with the necessary treatment. It is not good practice to take a

biopsy and then wait several days for the microscopic report before referring the patient to a specialist If the diagnosis is presumptive of cancer, time will be saved if the patient is sent at once to the specialist who will take his own biopsy

All tissue which is removed, even if it is not thought to be malignant, should be submitted routinely for microscopic examination Occasionally an unsuspected cancer is diagnosed in this manner This applies particularly to tissue attached to the root end of extracted teeth and to tissue found in extraction wounds with delayed healing

REQUIREMENTS FOR SATISFACTORY BIOPSY —Biopsy usually entails little

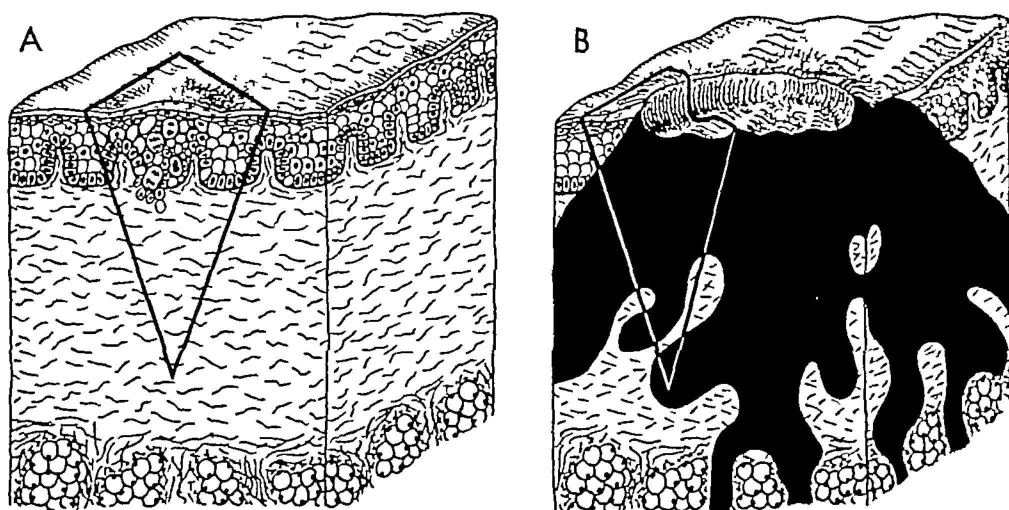


FIG 28 —Comparative values of biopsy of (*A*) early clinical stage of carcinoma (nodule) and of (*B*) far-advanced clinical stage (tumor, ulcer and metastasis) Biopsy of early lesion means diagnosis, complete removal and cure Biopsy of far-advanced lesion means only diagnosis

danger The malignant melanoma, however, should not be subjected to biopsy but should be removed completely, and other possible malignant tumors should be handled gently in order to avoid possible spread of the growth Vigorous palpation and injection of the local anesthetic agent into the tumor should be avoided (50) The risk of infection or hemorrhage is minimal Since only the tissue submitted can be examined and diagnosed, it is essential that the clinician choose a representative area for biopsy It is far better to take a narrow and deep rather than a broad but shallow piece of tissue A biopsy should include the margin of the tumor so that both normal and abnormal tissue may be obtained A section taken from a central area of ulceration may show only necrotic tissue If the biopsy is not extended deeply

enough, definite invasion of the base may be missed The tissue should be handled gently Small lesions may be excised entirely together with a wide margin of normal adjacent skin and underlying tissue.

DIFFERENT BIOPSY TECHNICS.—Although biopsies can be obtained in various ways the scalpel and tissue forceps are usually adequate for soft tissue biopsies of the oral cavity and face. The chisel and mallet are necessary of course, to obtain specimens of bone Other methods of removing tissue have been developed, such as cutting with either a biting forceps or a punch the use of the endotherm knife or electric cautery and puncture or aspiration with a large needle.

Cutting with a knife yields the best specimen particularly from the pathologist s point of view Accurate histologic diagnosis depends on the characteristic cell arrangement and structure and the staining quality of the tissue. Any alteration or destruction of these characteristics decreases the diagnostic value of the specimen Biting forceps often crush the tissue causing undesirable trauma both to the patient and to the tissue sample. Electrocautery often has been advocated as the method giving the least chance of metastases It avoids mobilizing living cancer cells and either implanting them locally into healthy tissue or facilitating their entry into opened blood and lymph vessels. Electrocautery destroys both malignant cells and normal tissue and also seals the blood and lymph vessels Quite frequently however this procedure also partially destroys the specimen Thus the cellular characteristics are distorted and unrecognizable. Specimens of normal tissue when so treated, may even appear malignant. Aspiration biopsy is sometimes deceptive. The malignant lesion may be missed by the puncturing needle Because the cancerous material is frequently mixed with other tissues and fluid it is more difficult to render a diagnosis.

FIXING OF SPECIMEN —The specimen is placed immediately in sufficient 10 per cent Formalin, at least 10 times its volume, to cover it completely (Fig 29) This fixes the tissue The specimen bottle should be tightly sealed.

PREPARATION OF BIOPSY REPORT —The biopsy should be accompanied by a report containing the patient s name address age and sex, a brief clinical history physical findings a description of the site of the lesion from which the tissue was removed and the tentative clinical diagnosis The doctor s name address telephone number date and method by which the specimen was taken should also be included Usually pathology laboratories will supply specimen bottles with the desired

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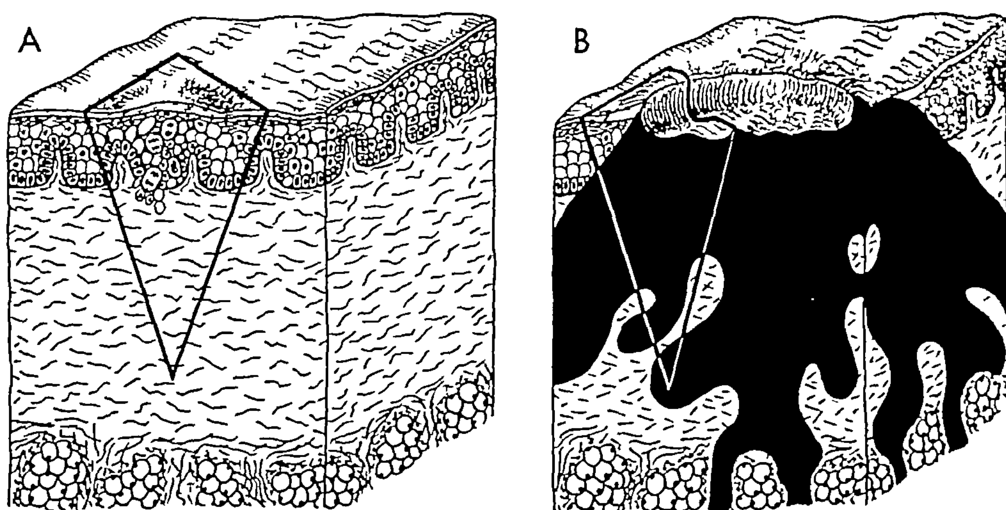


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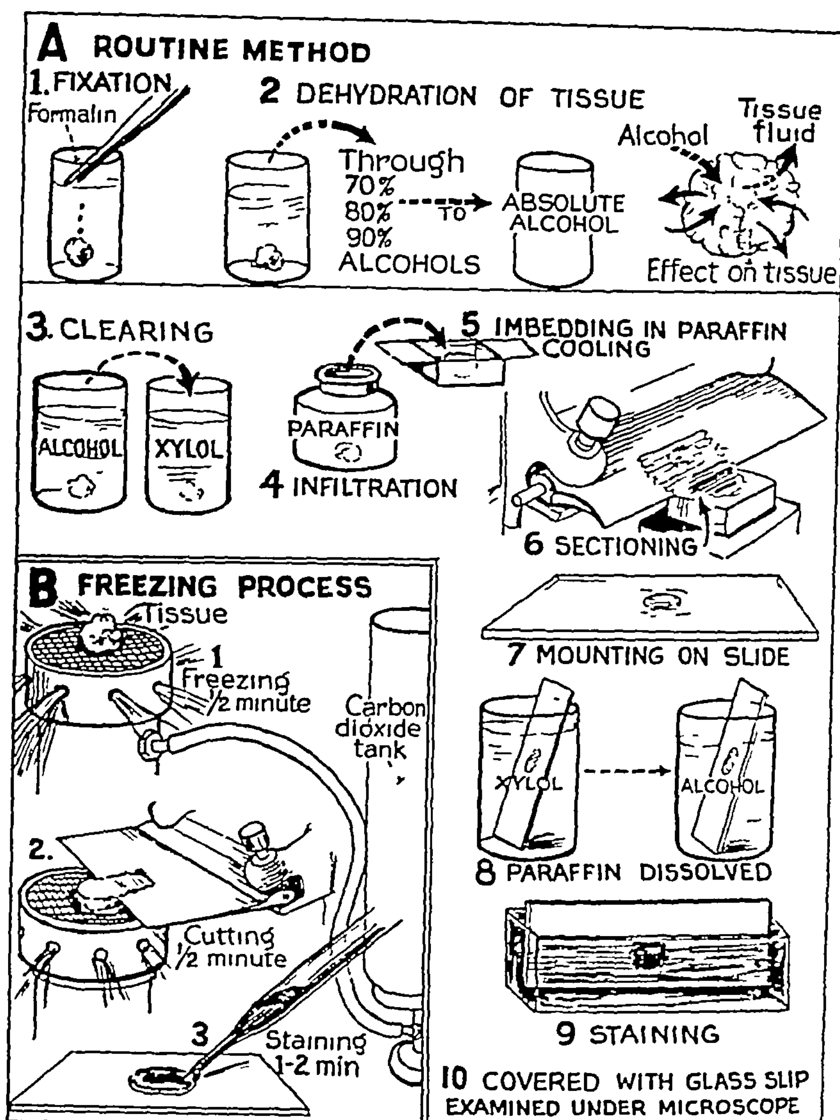


FIG 29 —Preparation of tissue for microscopic study *A*, routine method in which paraffin is used to give firmness to tissue to permit sectioning into thin slices Usually about a week is required for tissue preparation *B*, freezing method Carbon dioxide rapidly freezes tissue to firmness permitting sectioning into thin slices, so that within 30 minutes microscopic diagnosis can be made (Modified from Little, C C [ed] Preparation of Tissue for Microscopic Study, *Cancer* [New York American Cancer Society, 1946])

fixative fluid and a printed form bearing the questions to be answered The importance of a complete clinical report to aid the pathologist cannot be overemphasized Without it, he cannot be expected to render an accurate diagnosis

PREPARATION OF SPECIMEN —The pathologist or technician washes the tissue to remove the excess fixative solution (Fig 29) The specimen is placed in alcohol for dehydration and is usually embedded in paraffin. Thin slices can be properly stained and examined under a microscope The entire procedure takes a few days

A much more rapid procedure is available and is used particularly when the patient is on the operating table and anesthetized. The pathologist receives the suspected tissue from the surgeon in the operating room and immediately takes it to the laboratory The specimen is frozen by liquid carbon dioxide and the tissue is ready for microscopic examination in 30 minutes This method, however is not as reliable as that employing either paraffin or celloidin embedding

VALUE OF THE BIOPSY —Sometimes the report of a biopsy of a suspected cancer is either "normal tissue" or "no cancer seen." It is possible either that the particular tissue sent in for examination was normal or that the tissue was not properly prepared or examined. This negative report should not be accepted as final. Additional biopsies should be prepared to check the clinical diagnosis of suspected cancer A "negative" biopsy has been defined as one which should be repeated.

The microscopic examination of a biopsy specimen should help to answer the following questions

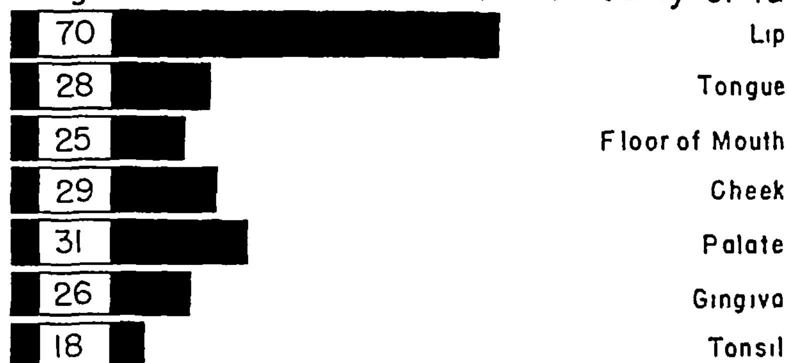
1 Is the lesion a neoplasm?
2. Is it benign or malignant?
3 What type of tumor is it?
4. What is the probable degree of malignancy?
5 What is the probable radiosensitivity?

MICROSCOPIC CHARACTERISTICS.—Histologically the epidermoid or squamous cell carcinoma of the oral mucosa may show different degrees of differentiation (Fig 30) That is, the cells may pass through the same metamorphosis that the normal and maturing stratified squamous epithelium undergoes Thus one may find hornification in the form of pearl formation Although the basement membrane has been broken through and groups of cells have invaded the underlying stroma, the cells retain many characteristics of those of the normal prickle cell layer Frequently the intercellular bridges are intact. The more benign the lesion, the more the tumor cells resemble those of the

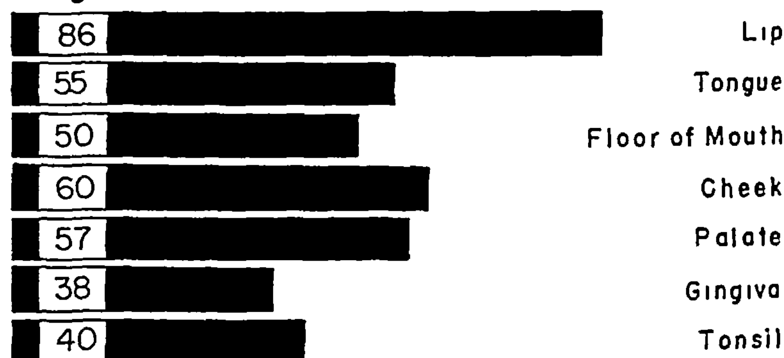
NEED FOR EARLY DIAGNOSIS OF ORAL CANCER

PERCENTAGE OF 5 YEAR CURE RATES
ALL PATIENTS TREATED

If diagnosed and treated either early or late



If diagnosed and treated early



Loss through lack of early diagnosis and treatment



Fig 31 —Percentages of five year cures when diagnosis and treatment are given early and late Note added percentage of five year cures which could be obtained if diagnosis and treatment were made early (Adapted from Martin, H J Am Dent A 33 815, 1946)

8 Discuss with a close responsible member of the family the need and reasons for early consultation with a specialist

9 Check with the consultant to be certain the patient has kept his appointment.

10 The specialist is responsible for the final diagnosis and treatment.

11 In the case of proved cancer maintain your interest in the patient and include in your office record the biopsy diagnosis, treatment given and post treatment course.

12 Co-operate with the physician and the tumor clinic in regard to oral care.

13 In case of any suspicion either of persistence of the original growth or of the beginning of a new one refer the patient immediately back to the specialist.

TABLE 3.—DELAY IN DIAGNOSIS OF MOUTH CANCER IN PATIENTS WHO CONSULTED A DENTIST BEFORE CONSULTING A PHYSICIAN

PRIMARY SITE OF CANCER	NO OF CASES	PROBABILITY OF CANCER RECOGNIZED BY DENTIST		PROBABILITY OF CANCER NOT RECOGNIZED BY DENTIST	
		No of Cases	Av Time Between 1st Seeing Dentist and 1st Seeing Physician	No. of Cases	Av Time Between 1st Seeing Dentist and 1st Seeing Physician
Gum	68	21(31%)	3½ wk.	47(69%)	5 mo
Palate	39	17(44%)	4 wk.	22(56%)	13 mo
Tongue	34	16(47%)	4 wk.	18(53%)	5½ mo
Mucosa of cheek	27	14(52%)	4 wk.	13(48%)	11 mo
Floor of mouth	29	18(62%)	1 wk.	11(38%)	5 mo
Total	197	86(44%)	3 wk.	111(56%)	7 mo

From Martin, H. *Mouth Cancer and the Dentist* (New York American Cancer Society Inc., 1949)

No better example could be given of the need for early recognition and referral of the patient with cancer than the statistics in Table 3 The patient, for whom the diagnosis of cancer was made when first seen by the dentist, reached the physician on the average in three weeks The patient, for whom the diagnosis of cancer was missed when first seen by the dentist, reached the physician on the average in seven months (22) This is the difference between the diagnosis of early and late cancer The prognosis is much more favorable when the cancer is treated early (Fig 31)

THE FAMILY DENTIST AND PHYSICIAN PLAY AN IMPORTANT ROLE IN THE EARLY RECOGNITION OF PRECANCEROUS AND CANCEROUS LESIONS EVERY PATIENT SUSPECTED OF HAVING CANCER IS ENTITLED TO IMMEDIATE EXPERT CONSULTATION

XI

Differential Diagnosis of Oral and Facial Lesions: Cancerous and Precancerous

Cancer is the most important diagnosis to make Therefore any lesion should be considered to be potentially cancerous until proved otherwise On this basis all lesions found in the oral cavity and on the face, or associated with these areas, which must be considered in the differential diagnosis can be classified into the following three groups (1) cancerous lesions, (2) precancerous lesions, (3) noncancerous lesions (Chap XXX).

Table 4 and Table 9 (p 197) give a more detailed classification They are not all-inclusive, but most of the important lesions are listed. Certain conditions are listed several times because they appropriately belong to more than one group The reader is referred to textbooks dealing with oral diagnosis (24), oral pathology (35) and oral surgery (3) for a more complete discussion

In addition to tumors also found elsewhere in the body, the oral cavity gives rise to specific tumors arising from the tooth-forming organs Thus, two types of growths are found (1) those which are dental in origin, and (2) those which are nondental in origin It is of interest to note that tumors of dental origin are rarely malignant Various conditions must be considered in the differential diagnosis of swellings of the face (Fig 27, p 77)

Cancerous Lesions (Malignant)

A malignant tumor may be defined as one in which cellular growth is uncontrolled (Table 5) There is no limiting capsule The growth

TABLE 4.—CLASSIFICATION OF CANCEROUS AND "PRECANCEROUS" ORAL AND FACIAL LESIONS

I. Cancerous (malignant) lesions

A. Epithelial in origin (carcinoma)

1. Primary
   - a) *Squamous* cell
   - b) Basal cell
   - c) Basal squamous cell
   - d) Adenocarcinoma (glandular)
   - e) Melanoma
   - f) Bowen's disease (carcinoma in situ)

2. Metastatic to jaws
   - a) Prostate
   - b) Breast
   - c) Thyroid
   - d) Ovary
   - e) Kidney
   - f) Lung
   - g) Rectum

B. Nonepithelial in origin (sarcoma)

1. Primary
   - a) In bones
     - 1) Spindle cell
     - 2) Fibrosarcoma
     - 3) Osteogenic
     - 4) Ewing's tumor
     - 5) Chondrosarcoma
   - b) In soft tissue
     - 1) Fibrosarcoma
     - 2) Lymphosarcoma

2. Metastatic to jaws

3. Generalized
   - a) Hodgkin's disease
   - b) Leukemia
   - c) Multiple myeloma

II. Precancerous lesions

A. Oral

1. Leukoplakia
2. Papilloma
3. Ulcer
4. Fissure
5. Wart

B. Facial

1. Senile keratosis
2. Scar
3. Lupus vulgaris
4. Lupus erythematosus
5. Nevus
6. *Xeroderma pigmentosum*
7. Chronic draining sinuses

infiltrates locally but may spread to a distant region (metastasize) and eventually cause the death of the host.

There are two types of malignant tumors: (1) carcinoma—a tumor which arises from epithelium (a covering and lining membrane) and (2) sarcoma—a tumor which arises from nonepithelial tissues (primarily connective tissue).

Tumors of epithelial origin (carcinoma)—PRIMARY CARCINOMA—These malignant epithelial neoplasms arise locally from the stratified squamous epithelium of the skin or mucous membrane or from the glandular elements If the tumor has the histologic characteristics of the outer layers of the stratified squamous epithelium, it is known as a squamous cell carcinoma If the tumor resembles the deeper or basal layer, it is known as a basal cell carcinoma Clinically, the squamous cell carcinoma grows faster and metastasizes early The basal cell carcinoma grows more slowly, seldom metastasizes and may have a tendency to invade bony cavities such as the nose, orbit and auditory canal If certain of the glandular cells undergo malignant change, the tumor is known as an adenocarcinoma This is found most often in the parotid gland and the palatal glands The most malignant of all tumors is the melanoma, which grows rapidly and metastasizes early It is coal black It may be seen on gingiva, buccal mucosa and skin

TABLE 5 —CHARACTERISTICS OF BENIGN AND MALIGNANT TUMORS*

	BENIGN TUMOR	MALIGNANT TUMOR
Structure	Structure often typical of particular tissue of origin	Structure often atypical, i e, differentiation imperfect (anaplastic)
Mode of growth	Growth usually purely expansive and capsule formed	Growth infiltrative and expansive, so strict encapsulation is absent
Rate of growth	Usually slow, mitotic figures scanty	May be rapid, with many mitotic figures
End of growth	May come to standstill or retrogress	Growth rarely ceases, usually progressive to death
Metastasis	Absent	Frequently present
Clinical results	Dangerous only because of a) position, compression of vital organs (brain, blood vessels, trachea), or b) accidental complications, or c) production of excess of hormone	Intrinsically dangerous because of progressive infiltration and metastasis

*Modified after Willis, R A *Pathology of Tumours* (St Louis C V Mosby Company, 1953)

METASTASIS TO JAWS —Some oral carcinomas have metastasized from a primary lesion in a distant organ Thus, carcinomas of the prostate, thyroid, kidney, breast, ovary, rectum and lung tend to metastasize to

bones and so may involve the jaws The histologic picture of the primary growth is often duplicated in the metastatic lesions These secondary tumors, because they are metastatic, are usually located within the center of the jaw Diagnosis of the primary tumor is sometimes made only after histologic examination of the metastatic lesion (Fig 80 p 188)

Tumors of nonepithelial origin (sarcoma)—PRIMARY SARCOMA.—These malignant nonepithelial neoplasms arise from the more deeply situated tissues of the oral cavity and adjacent structures Most sarcomas arise from the tissues of the bones Consequently the tumors are frequently centrally located in a bone and lead to its enlargement. This enlargement results from destruction of the bone from within and apposition of new bone on the outer surface and leads to asymmetry of the part (Fig 73 p 174) Because of pressure on nearby nerves pain may be one of the earlier complaints Sarcomas usually occur in the younger age groups (first to fourth decade) They grow rapidly and, as a rule are generally resistant to radiation therapy Surgical treatment is usually deforming The prognosis is not good (Chap XXIX)

METASTASIS TO JAWS.—Occasionally a sarcoma in some remote part of the body such as the femur metastasizes to the jaws One must be on guard not to miss this possibility

GENERALIZED —Leukemia is sometimes considered to be a sarcoma of the blood forming organs In leukemia the gingiva may be enlarged and show characteristic changes which at times constitute one of the earliest diagnostic signs (see Fig 68 p 161 and Chap XXIV) (86)

"Precancerous" Lesions

In the cancer susceptible individual, lesions subjected to adequate irritation over a long enough period may undergo malignant change

Leukoplakia, the papilloma, the fissure the ulcer and the wart are the common chronic lesions which sometimes become cancerous (Fig 70 p 166) It must be pointed out that not all of these will become malignant, so that when the term precancerous is used it is done with certain reservations (Chaps XIV and XXIV)

Leukoplakia.—Leukoplakia, which appears as a white thickening may be found on the vermilion zone of the lips (Fig 24, p 73) and anywhere on the mucous membrane of the oral cavity (Fig 70 A and B) The surface may vary from one which is quite thin smooth

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and barely palpable (grade I) to one which is quite thick and leathery (grade IV) In the latter type, chronic fissures or ulcers are sometimes seen Biopsy specimens of these areas should be examined carefully for possible malignant change All patients with oral leukoplakia should avoid oral irritants (spices, spirits, smoke, etc) and should be examined at regular intervals

Fissures —The chronic labial fissure extending from the skin border of the vermilion zone to the mucous membrane, particularly in the midline of the lower lip, may have been present since infancy (Fig 70, *E*) It may heal to some extent in the summer and become open, secondarily infected and painful in the winter The often repeated sequence of healing and breakdown and the continued irritation sometimes lead to malignant change The fissure should be completely excised and the tissue examined microscopically

Papilloma —The papillomas, polyps and benign neoplasms which occur on either the tongue or mucosal surface of the cheek are frequently subjected to trauma by the teeth (Fig 70, *C*) It is a relatively simple surgical procedure to remove the lesion Such early treatment is strongly recommended Although these lesions seldom become malignant, papillomas of the urinary bladder and polyps of the colon are considered by some to be precancerous and even cancerous

Ulcer —The chronic ulcer, particularly on a traumatic basis, should also be considered a precancerous lesion A rough tooth or dental appliance may be the irritating factor causing the ulcer (Fig 70, *D*). Usually after the causative agent is removed the ulcer heals If, however, the ulcer does not heal or show definite signs of healing in one to two weeks, the lesion should be viewed with suspicion

XII

Differential Diagnosis of Swellings of the Neck

SWELLINGS OF the neck vary in origin (Table 6) Some develop primarily in the neck and others secondarily No attempt will be made to describe all of these tumors only a selected few of greatest interest will be mentioned. The most important one to remember is the hard, fixed, nontender mass This is indicative of cancer and requires a thorough examination of the face, oral cavity oro hypo- and nasopharynx to locate the primary site.

PRIMARY SWELLINGS OF THE NECK

The primary swellings of the neck may be classified as developmental, inflammatory and neoplastic lesions and dilatations (aneurysm, diverticulum) Those which will be described are the thyroglossal duct cyst, the lateral cervical cyst (branchial cleft) and the cystic hygroma

Developmental—THYROGLOSSAL DUCT CYST—The thyroglossal duct cyst may be found anywhere from the base of the tongue at the foramen caecum to the isthmus of the thyroid gland (Fig 32, *A*) This is the course followed in the development of the thyroid gland into the neck during the embryonic period. Usually the duct atrophies When the thyroglossal duct does not completely atrophy a cystic swelling 1–4 cm. in size may appear superficially in the midline of the neck, usually just below the hyoid bone This develops most often before puberty as a painless progressively enlarging, fluctuant to soft, movable mass. The cyst moves upward when the tongue is protruded or during swallowing

TABLE 6 —CLASSIFICATION OF SWELLINGS OF THE NECK

I Primary swellings
  A Developmental
    1 Thyroglossal duct cyst
    2 Lateral cervical cyst (branchial cleft)

  B Inflammatory

  C Neoplastic
    1 Related to lymph and blood vascular system
      a) Cystic hygroma
      b) Lymphangioma
      c) Hemangioma
      d) Tumor of carotid body
    2 Glandular origin
      a) Parathyroid
      b) Thyroid (also aberrant)
      c) Salivary
      d) Sebaceous
    3 Connective tissue
      a) Lipoma
      b) Fibroma
      c) Neurofibroma
    4 Composite dermoid

  D Dilatations
    1 Aneurysm
    2 Pharyngeal diverticulum

II Secondary swellings of the neck
  A Regional origin
    1 Inflammatory (secondary to teeth and tonsils)
      a) Lymphadenitis
      b) Abscess
      c) Cellulitis
    2 Neoplastic
      a) Metastasis of oral, nasal, facial, pharyngeal and esophageal cancer
      b) Metastasis of cancer from below the clavicles

  B Nonregional origin
    1 Inflammatory
      a) Tuberculosis
      b) Syphilis
    2 Neoplastic
      a) Leukemia
      b) Hodgkin's disease
      c) Lymphosarcoma

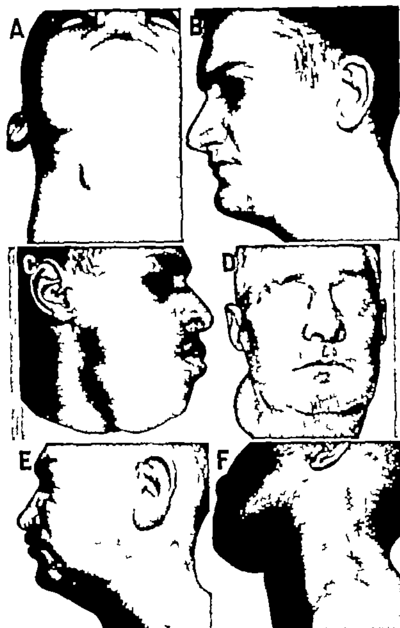


FIG 32—Swellings of the neck *A*, thyroglossal duct cyst, a midline lesion of developmental origin *B* lateral cervical cyst (branchial cleft) a lateral lesion of developmental origin *C* tuberculous lymph nodes with are firm and matted together and may be mistaken for tumor Roentgen irradiation is treatment of choice. *D* lipoma, a soft, freely movable mass present over 30 years without perceptible growth. In roentgenograms it was more radiolucent than normal, which is diagnostic of fatty tumor *E* metastatic carcinoma, a voluminous firm, fixed painless mass involving considerable portions of submandibular and upper cervical regions Primary lesion is in the tongue Only palliative treatment could be given. *F* Hodgkin's disease Note enlarged cervical chain of lymph nodes

An upper respiratory infection may cause it to become infect that it may rupture spontaneously and drain Recurring attacks flammation or a discharging fistula causes the patient to seek a The discharge is intermittent and slight except when activated l fection Incision and drainage of the cyst will not result in a cur will cause a fistulous tract to develop The cyst and the entire which may go through the body of the hyoid bone, must be comp dissected out to the base of the tongue

LATERAL CERVICAL CYST.—The *lateral cervical cyst* (branchial cyst) is found in the neck anterior to the sternocleidomastoid m (Fig 32, *B*) This is in contrast to the thyroglossal duct cyst, is found in the midline The lateral cervical cyst represents a rem of the cervical sinus, of which there are a right and a left po whereas the thyroglossal duct cyst is single, in the midline an velops from an unpaired structure Thus the relative positions ar termined on an embryologic basis Although the lateral cervica may not be recognized until adolescence, it or its anlage has been ent since an early embryonic stage

The cyst grows very slowly, is oval and may become as lo 10 cm It is usually larger than the thyroglossal duct cyst It is locular, smooth, fluctuant, moderately movable and not attached t skin The lateral cervical cyst is sometimes mistaken for an absces incised and drained *Microscopic examination* of the cheesy cor reveals cholesterol crystals, which are diagnostic Injection of opaque substances into the fistula may reveal a tract opening int tonsillar area The patient may complain of a bitter taste in the m Incision and drainage, curettage and the use of caustics only resu the establishment of a fistula The cyst should be excised compl

Neoplastic lesions Related to lymph and blood vascular syst

CYSTIC HYGROMA —Cystic hygroma (*hygros* [moist] and *oma* [tum or hygroma colli is a benign multilocular, soft, diffuse cystic found in relation to the deep fascia of the neck and in the regi the sternocleidomastoid muscle at its insertion near the clavicle It also be found in the axillary region (hygroma axillare) The tum lymphatic in origin and the cavities are lined with true endothe and contain lymph The mass is usually discovered shortly after and almost always before age 12 The growth is progressive, and o sionally important structures such as the trachea, pharynx and n plexuses are encroached upon The large hygroma may become ondarily infected

Treatment, which is primarily surgical, should be instituted early and should be radical. Dissection, although quite difficult, should be complete, because any abnormal tissue left behind will continue to grow It can be done more easily at an early age when the different layers of tissue can be dissected with less difficulty In addition, dissection is more difficult after infection and scarring have occurred. Sometimes the injection of sclerosing solutions which must be used cautiously is of value in small tumors In extensive tumors, irradiation may be tried, but as a rule these tumors tend to be resistant to such therapy Aspiration is futile because the fluid reforms at once and the procedure may lead to a secondary infection Incision and drainage should not be resorted to because if the wound becomes secondarily infected, sepsis and toxemia may be fatal. In addition prolonged palliative treatment only permits the tumor to spread so that it becomes inoperable.

Secondary Swellings of the Neck

The swellings in the neck which are secondary to a nonlocal pathologic process may be classified as follows

A. Regional in origin
  1 Inflammatory (secondary to teeth and tonsils)
  2 Neoplastic
B Nonregional in origin
  1 Inflammatory
  2. Neoplastic

Regional in origin.—INFLAMMATORY —Acute cervical lymphadenitis is most frequently seen during childhood (Table 6) The lymph nodes are enlarged and tender and exhibit the signs and symptoms of acute inflammation. Periapical infections of the teeth and tonsillitis are common causes Dental infection may spread into the submaxillary and cervical regions to cause either cellulitis or an abscess

The cervical lymph nodes may also be chronically enlarged because of a focus of infection in the teeth and tonsils The nodes are not tender are not unusually firm and are movable Before either teeth or tonsils are removed, it is most important to determine that the enlarged cervical lymph node is not due to a carcinoma of the oral cavity or adjacent areas.

NEOPLASTIC.—The most common cause of cancer of the neck is secondary lymphatic spread from a primary carcinoma in the mouth, pharynx, nasal cavity maxillary sinus or face (Figs 32, *E* 67 *A* p

159, and Table 6) It is most important to rule out this diagnosis first The lymph nodes are enlarged, firm, frequently fixed to the underlying tissue and painless Sometimes the primary lesion looks like an innocent small fissure between the tongue and the anterior tonsillar pillar (Fig 52, p 135) At other times no lesion is found If such be the case, repeated thorough examinations are necessary, with particular attention paid to the epiglottis, base of the tongue, palatine tonsils and oro- and nasopharynx In addition, a competent rhinolaryngologist should be consulted to examine the hypo- and nasopharynx and nose thoroughly It is not uncommon to find that the first clinical sign of intraoral carcinoma is a mass in the neck This metastatic mass is frequently located just below and behind the angle of the mandible

Unfortunately, the asymptomatic cancerous mass in the neck is sometimes thought to be a result of spread of infection from the teeth or tonsils With this misdiagnosis the teeth and tonsils are removed but the cervical mass continues to increase in size

Nonregional in origin —The lymph nodes of the cervical region may become enlarged in certain generalized conditions which involve the lymphatics primarily (Table 6) Hodgkin's disease (Fig 32, *F*) and the leukemias are examples In tuberculosis (Fig 32, *C*) and syphilis the cervical lymph nodes may also be affected. This is not as common today as in the past

A SWELLING OF THE NECK IS SOMETIMES THE FIRST SIGN OF EITHER ORAL OR FACIAL CANCER

XIII

General Clinical Considerations

No CAVITY of the body is as accessible to complete examination as the mouth (Fig 33 and see Chap VII) Visual digital and roentgenographic examinations are readily performed Examination of the stomach, rectum, bladder and uterus is much more difficult and requires special technics In view of this one might logically conclude that oral cancer should be detected earlier and therefore be better controlled than cancer occurring elsewhere. Unfortunately many cases of oral cancer are seen late Early recognition is the responsibility not only of the patient but of the dentist and physician The oral cavity and particularly the oral mucosa, has long been a "no man s land" To the physician the mouth too frequently is a cavity through which he observes the tonsils and throat. To many dentists the mouth is largely the gateway to the teeth and jaws

Cancer in the oral cavity is so favorably located for an early diagnosis that the condition may even be suspected by the informed patient. Such a diagnosis however must be confirmed by microscopic study of the biopsy specimen by a qualified pathologist (see Chap IX) Dental or oral problems will often bring the patient to his dentist long before he has occasion to visit his physician. In such cases the dentist is in the unique position of being able to diagnose oral cancer even earlier than the physician, provided the oral examination is complete. The physician likewise should routinely perform a complete oral examination. It is not complete however without an extraoral regional examination (Figs 17 and 18 pp 63 and 65) Since cancer of the oral cavity like other cancer tends to spread, metastatic masses may be found, most frequently in the submental, submandibular and lower cervical regions (see Chap XXIII) In a study of cancer in the state of Connecticut, metastases to the neck were noted on the first examina

tion in 36 per cent of patients having head and neck cancer Less than 5 per cent of oral cancer spreads below the clavicle The presence of tumors in the neck is therefore an immediate indication for a search for the primary lesion in the oral cavity and face In addition to masses in the neck, the dentist should be alert for tumors (especially when

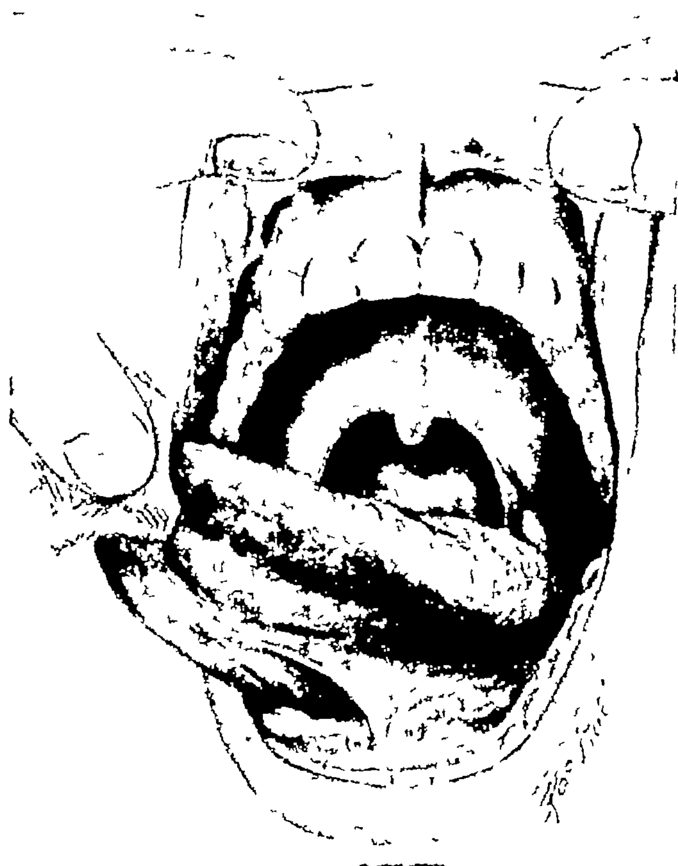


FIG 33 —The oral cavity Areas where cancer may develop are the lips, buccal mucosa, floor of mouth, tongue, palate, gingiva, tonsils and salivary glands These can be examined readily and without special aids

coal black) and ulcers of the scalp, face, eyelids, ears and nose In case of suspicion the patient should immediately be referred to a qualified specialist.

SEQUENCE OF ORAL EXAMINATION

Since the dentist will, by habit, concentrate on the examination of the teeth and the gingiva and pay less attention to other structures, a suggested routine is to start the oral examination with the nondental

structures and to examine the teeth and gingiva last (Figs 16 19–22, pp 60 f and 66 ff) Although a careful examination of the nondental structures will take a very short time, the dentist may find it more practical to begin with the dental structures A proper oral examination, both extraoral and intraoral, should proceed according to the following systematic sequence in order to assure completeness

A. Extraoral examination
1 Face
2 *Parotid and submandibular salivary glands*
3 Submandibular and submental lymph nodes
4 Jaws and temporomandibular joint
5 Neck and cervical lymph nodes
6 Lips and corners of mouth

B Intraoral examination
1 Mucous membrane of lips and cheeks and papillae of parotid ducts
2 Floor of mouth, sublingual gland and submandibular duct
3 Tongue (all surfaces)
4 Palate (hard and soft)
5 Tonsils and tonsillar pillars
6 Posterior pharyngeal wall
7 *Retromolar area*
8 Gingiva and alveolar bone (periodontal pockets, interdental areas)
9 Teeth

The following four clinical findings in any lesion especially when occurring in combination should bring a strong suspicion, if not a positive clinical diagnosis, of cancer (1) chronicity (2) tumefaction, (3) induration, and (4) ulceration.

Any ulcer which fails to heal in two to three weeks should be considered malignant until proved otherwise. In the oral cavity and face, carcinomas may be multiple. If a patient has one carcinoma that has developed on the basis of leukoplakia, for instance the possibility of his developing another cancer is higher than in an individual without cancer The discovery of one cancer requires that the patient be examined periodically to ascertain that the original growth has been controlled, that new cancers have not developed at other local sites and that there has been no spread of the cancer

As soon as a tentative diagnosis has been made and verified by biopsy immediate, adequate treatment is imperative Delay is inexcusable. If necessary either the patient or a close responsible member of the family should be acquainted with the need for haste and for a

race against time Every day of waiting is one of gain for the cancer and loss for the patient

The most important single factor in the early diagnosis of oral cancer is the constant alertness of the patient as well as of the dentist and physician Cancer should be considered first in the differential diagnosis The early signs and symptoms may often be vague and obscure The early stages of cancer of the mouth and face are therefore not always readily recognized Unfortunately, pain is a late symptom of cancer, not an early one (see Chap VIII)

The carcinoma which most frequently attacks the oral mucous membrane and skin is the epidermoid or squamous cell type. In its earliest clinical stages it is small, innocuous looking and painless Consequently proper treatment may be delayed or the wrong treatment may be given, such as the application of caustics, which aggravate the disease The progress of cancer in the soft vascular mucous membrane of either the mouth or pharynx is often quite rapid Within two or three weeks a small carcinoma of the mouth may become transformed from a strictly localized lesion into an ulcerating, rapidly growing and infiltrating one Delay in determining the nature of either a small innocuous looking nodule or fissure, because of failure to evaluate positive clinical data and to perform a biopsy, permits many an early, easily treatable cancer to reach an advanced stage This either entails a serious therapeutic procedure or offers a poor prognosis under any treatment It is only in the late phases that the commonly described symptoms of anorexia, anemia, weight loss, weakness and large masses are seen When cancer is diagnosed at this stage, it usually cannot be treated

Although one thinks of cancer as a disease of later life, it must be pointed out that it does occur and is not at all rare in children Cancer is a common cause of death in the age group up to 14 years Cancer should therefore not be ruled out because of the youth of the patient (see Chap XXIX)

ANY ULCER WHICH FAILS TO HEAL WITHIN TWO TO THREE WEEKS SHOULD BE CONSIDERED TO BE CANCER UNTIL PROVED OTHERWISE

Carcinoma of the Soft Tissues (Face and Mouth)

XIV

Cancerous and Precancerous Lesions of the Skin

Anatomic and Physiologic Considerations

The skin is the outermost body covering and serves as the receptor between the body and the external environment It is directly continuous with the mucous membrane of the alimentary canal and with the orifices of all organs which communicate with the outside Its color and texture vary not only in different parts of the body but also with age, sex, race and environment.

The skin performs many valuable functions It protects the body from injurious substances it receives tactile thermal and painful stimuli, it helps regulate body temperature it is an excretory organ, and it prevents the excessive loss of fluids from the body

The skin is composed of two parts (Fig 34) The outer layer the epidermis, is a stratified squamous epithelium the deeper or inner layer the derma (dermis, corium, cutis vera) is composed of dense connective tissue Beneath the derma is a layer of loose connective tissue, the hypodermis subcutaneous tissue or superficial fascia, which may contain fat.

Epidermis –The epidermis is divided into four layers (1) the stratum germinativum, (2) the stratum granulosum (3) the stratum lucidum, and (4) the stratum corneum (Fig 34) The stratum germinativum is the deepest layer of the epidermis and is separated from the derma by the basement membrane. The stratum corneum is the outer

most layer and is the one in contact with the external environment.

The stratum germinativum, the deepest and most active layer of the epidermis, consists of many layers of cells which extend between the papillae of the derma The innermost basal cell layer lying next to the derma and connected with it by the basement membrane consists of

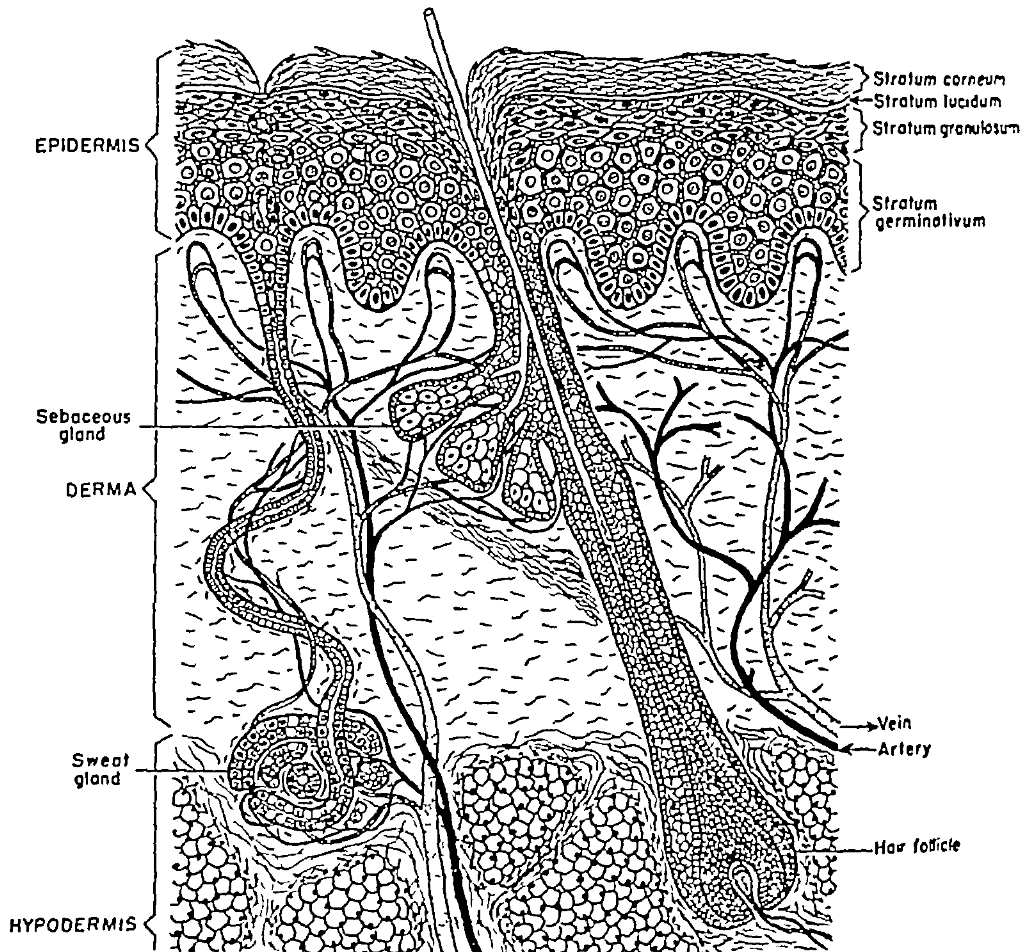


FIG 34 —Histologic structure of normal skin (nerves and lymphatics omitted)

a single row of cylindrical cells These cells contain a variable number of melanin or pigment granules The cells of the basal layer show mitotic activity The remaining portion of the stratum germinativum is made up of polyhedral cells which become flattened toward the granular layer The cells of the stratum germinativum are connected by conspicuous intercellular bridges This layer, therefore, is known as the stratum spinosum and shows more mitotic activity than the basal layer

It furnishes cells for the regeneration of the stratum corneum which is continuously shed.

The stratum granulosum is built up of one to four rows of flattened cells which appear rhomboidal in shape if cut at right angles to the surface. They contain distinct deeply staining keratohyalin granules of regular form and size. These granules are regarded as a preliminary stage in the formation of the horny substance, keratin, which is found in the stratum corneum.

The stratum lucidum the next most superficial layer is differentiated distinctly only when there is a well developed stratum corneum The stratum lucidum consists of two or three layers of flat, closely packed, clear cells which are not completely cornified They contain no nuclei and the granules are dissolved into eleidin. Under the microscope this layer appears as a pale wavy stripe.

The stratum corneum, the outermost layer is composed of flat, horny non nucleated cells which are continuously being desquamated. This layer varies in thickness in different parts of the body being thickest on the palm of the hand and the sole of the foot.

Derma.—The derma or cutis lies immediately below the epidermis (Fig 34) It consists of fibrous connective tissue bundles arranged in an irregular pattern. There are two layers the uppermost or papillary layer which has papillae extending into the epithelium, and the deeper reticular layer These two layers show no sharp line of demarcation. The reticular layer is poor in cells and consists mainly of a dense net work of collagenous and elastic fibers

The nerves of the skin are mainly sensory some reach into the stratum germinativum of the epidermis to end between the cells Others end in the derma or in the subcutis in connection with specific sensory end-organs The blood vessels are found in the derma but not in the epidermis The larger branches are in the subcutaneous layer the smaller ones in the derma They are characterized by rich anastomoses The capillary networks also reach in to the papillae of the derma where they approach the epidermis The veins form superficial networks in the deep part of the corium. Lymphatic vessels are abundant in the subcutaneous and papillary layers The skin contains accessory structures such as the sweat and sebaceous glands and hair follicles These extend usually from the depth of the derma through the outer layer of the epidermis.

Hypodermis—The hypodermis or subcutaneous layer is deep to the skin proper and consists of strands of connective tissue with variably

large amounts of fatty connective tissue It permits movement of the skin but is still connected to the underlying fascia.

Clinical application—A knowledge of the histologic structure of the skin is important for an understanding of the cancerous lesion and of the basis of skin grafting When grafts which include a portion of the derma are taken, a bland dressing is usually placed over the donor site This area heals by regeneration and spread of the epithelium from the surface of the sweat and sebaceous glands and hair follicles as well as remnants of epithelial ridges which may have been left behind (Fig 34, and see also Fig 108, p 241) When a full-thickness graft is taken, both the epidermal and dermal layers are excised down to the hypodermis By this procedure the glands and the epithelial remnants are removed and there is little likelihood of the donor site being covered spontaneously by epithelium. Consequently, after a full-thickness graft is taken it is important either to close the wound by advancement of adjacent skin or the application of a partial thickness skin graft from some other area.

Clinical Considerations

Cancerous lesions—Of all cancer, that of the skin is most readily accessible for diagnosis (26, 83) It is usually slow-growing and metastasizes late if at all There is a high rate of survival after proper treatment One state medical society tells its members "A death from carcinoma of the skin is a reflection upon the medical profession of the community where it occurs" For the purpose of this book, only the skin of the face will be considered Here, as elsewhere, the tumors may arise from the epithelium (carcinoma) or from the underlying nonepithelial tissues (sarcoma) (Table 4, p 93) From the clinical point of view, four major types of skin cancer should be considered: (1) squamous cell carcinoma, (2) basal cell carcinoma, (3) malignant melanoma, and (4) adenocarcinoma

SQUAMOUS CELL CARCINOMA—Squamous cell carcinoma of the face may be caused by prolonged exposure to solar rays Consequently, it is most common among persons exposed to the sun over long periods, such as farmers and sailors (farmers' skin, sailors' skin) In sailors, these cancers may be seen at an earlier age than in farmers because of increased exposure due to reflection of the rays from the water and possibly the irritation of the skin by salt and wind In addition, there may be an increased incidence of cancer of the skin among individuals ex-

posed to arsenicals nitrates and hydrocarbons In persons of light complexion cancer of the face tends to develop much more readily than in those of dark complexion or with thicker skin.

Squamous cell cancers vary in their manner of growth. Some may grow outward and look like a small wart. Others may grow into the depth of the tissue infiltrate the dermis and the subcutaneous layer and thus immobilize the overlying skin. Later they may ulcerate. At this stage usually the patient first seeks help This type of cancer is as a rule painless and its growth may be slow Growth may be determined by the amount of irritation In contrast to other carcinomas they are often multiple rather than single Sometimes they are mistaken for benign tumors The squamous cell carcinoma of the skin of the face and neck seldom metastasizes Basal squamous cell lesions are also seen.

BASAL CELL CARCINOMA.—The basal cell carcinoma almost never metastasizes. Early in the clinical course it is a small, discrete, nonulcerated, painless innocent looking pearly nodule This lesion begins in the basal layer of the epidermis. A short time later it may appear as a hard, infiltrated nodule with a smooth slightly raised rolled border As the growth enlarges the epithelium becomes thinner and eventually umbilicates and ulcerates in the central part. The basal cell carcinoma may burrow into the underlying tissue and may invade bony cavities such as the orbit, auditory canal and nasal cavities The tumor although slow in growth and local in destruction is sometimes difficult to control and may become quite extensive (Fig 35 A)

MALIGNANT MELANOMA (MELANOBLASTOMA)—The malignant melanoma is probably the most malignant of all tumors Originating from the pigment cells in the region of the dermoepidermal junction it is characterized by early and widespread metastases It may look like a coal black area and may be differentiated in most instances from the benign melanoma (melanotic nevus) primarily by its clinical characteristics Fortunately the malignant melanoma is not common. It is occasionally found in the mouth, but it should not be confused with the brown pigmentation of the gingiva seen frequently in Negroes and occasionally in Caucasians of dark complexion Repeated trauma or irritation from caustic or other inadequate treatment may transform a benign melanoma into a malignant one If there is the slightest question of malignancy the tumor should not be biopsied but should be excised widely This is one of the few tumors in which a biopsy may readily dislodge the malignant cells and cause metastases Benign

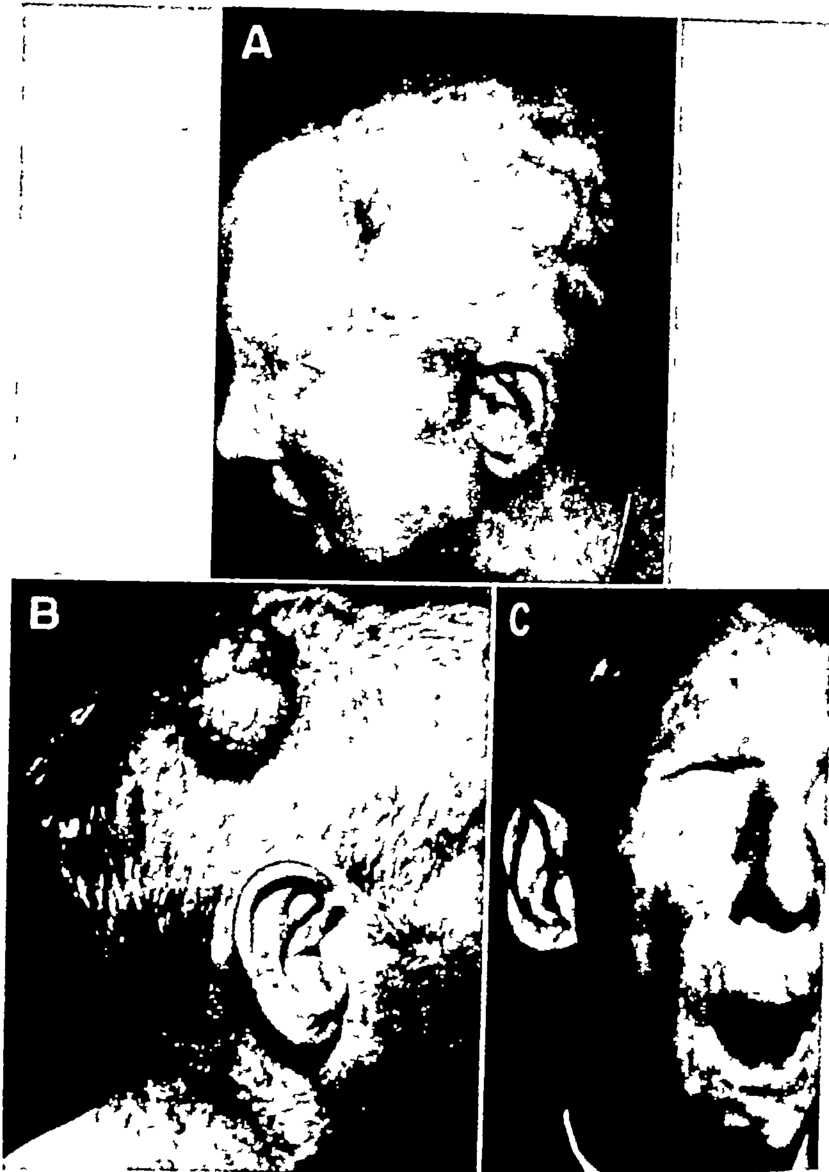


Fig 35—*A*, advanced basal cell carcinomas of face and scalp Biopsies of skin along external canthus of eye, in front of ear and on scalp showed basal cell carcinomas Note atrophy, scarring and loss of hair from x-ray therapy, which was ineffective *B*, adenocarcinoma of scalp This "sebaceous cyst" was removed and on routine microscopic examination was diagnosed adenocarcinoma Radical surgery was instituted *C*, senile keratoses—precancerous lesions resulting from outdoor exposure for many years On forehead and scalp note numerous freckle-like lesions—dry, hard, adherent, yellow-brown crusts Underlying tissue is thin and often is ulcerated

brown, hairy moles and nevi should not be mistaken for malignant melanoma.

ADENOCARCINOMA.—Adenocarcinoma of the skin is rare. It arises from either the sweat or the sebaceous glands (Fig 35 *B*)

Precancerous lesions —Senile keratosis irritated scars lupus erythem



FIG. 36 —*A*, radiodermatitis Radium applied in infancy to a hemangioma at the side of the nose destroyed the lesion but also altered the skin, as evidenced by atrophy telangiectasis and hyperpigmentation. This may change into cancer in later years Radiation may also affect the growth sites of the area. *B* carcinoma of skin in the site of a thermal burn 25 years before. The chronic, ulcerated lesion is indurated and fixed to underlying tissue The ulcer was secondarily infected and irritated and eventually healed by scar only to ulcerate again. This process was repeated many times. The early lesion should have been excised and covered with a skin graft before cancerous changes could occur

atosus lupus vulgaris and xeroderma pigmentosum are some of the precancerous conditions of the skin (see Chap XXV) Bowen's disease more recently has been considered not as a precancerous lesion but as a carcinoma in situ which has not penetrated the basement membrane (Table 4, p 93)

SENILE KERATOSIS.—Senile keratosis is important because it is the most common precancerous lesion of the skin (Fig. 35, *C*). It occurs on portions of the body which have been exposed for prolonged periods, primarily to the exigencies of the weather. The forehead, temple, upper part of the cheeks, nose and ears are common sites. The lesion varies in size from one to several millimeters. It is slightly elevated and usually scaly or covered with a dry, hard, adherent, yellow-brown or gray crust which may be peeled with great difficulty (Fig. 35, *C*). The underlying skin is thin, in some areas may be ulcerated and may bleed readily. The lesion may remain quiescent for many years but can eventually become malignant. Other exposed portions of the body, such as the hands, should also be checked for keratoses.

SCARS.—Scar tissue exposed to chronic irritation may undergo malignant change much earlier than normal tissue. Scars resulting from thermal or radiation injury (Fig. 36, *A*) may heal and break down frequently over a period of years. Eventually the ulcer may be transformed into a malignancy (Fig. 36, *B*). This same process may occur in long-standing ulcers, scars or draining sinuses due to tuberculosis, syphilis and osteomyelitis. Squamous cell carcinoma has been reported in the skin of chronic draining sinuses caused by osteomyelitis. The underlying cause should, of course, be treated. Patients with these conditions should be examined regularly and carefully. The scar should be excised completely and a free skin graft or pedicle flap applied long before the possibility of malignant change may arise. In this way, normal tissue is substituted for the abnormal.

CASE HISTORY

F. A. White man, aged 65.

Chief complaint. Sore on face of six months' duration.

Onset and course. Patient is a farmer who spends much time outdoors. He does not tan readily. During the past few years several small sores had developed on his face. These cleared up during the winter months. However, at present, two of the areas have failed to heal. Neighboring farmers have told him that he has "farmers' skin." General health has been excellent.

Physical examination. A well developed, well nourished man of light complexion. In the skin of the face and arms are areas of redness, pigmentation and depigmentation.

Regional examination. (1) On the left side of the nose just above the alar border is a superficial ulceration 1 × 2 mm. The border is irregular and rolled, the base firm. (2) There is a similar but smaller lesion at the junction of the cheek and the alar cartilage. (3) An area 1 × 3 mm on the bridge of the nose is covered by atrophic skin.

Tentative diagnoses (1) and (2) Squamous cell carcinoma. (3) Senile keratosis

Laboratory reports Biopsy—(1) and (2) squamous cell carcinoma (3) senile keratosis. Serology—blood Wassermann and Kahn reactions negative.

Final diagnoses (1) Squamous cell carcinoma of the skin of the nose (2) Senile keratosis of the skin of the nose

READILY *SEEN*—READILY *TREATED*—READILY *CURED*

XV

Carcinoma of the Lip

Anatomic and Physiologic Considerations

The lips are muscular bands which serve as the front gates of the oral cavity When closed they meet at the level of the incisal third of the upper teeth. Thus the upper lip is in contact with the upper teeth only, while the lower lip touches both the upper and the lower incisors and cuspids This varies, however, when the lower jaw changes from the occlusal to the rest position The junction of the lips forms the angle or commissure of the mouth It is usually located between the cuspid and the first bicuspid A failure of union of the formative components of the lips results in various types of clefts These are not common

Normally the upper lip protrudes slightly more than the lower one Occasionally the upper lip is so short that the gingiva is readily visible This results in local chronic irritation through the thermic and drying effect of the air, especially during sleep

An excessively short upper lip may indicate an abnormal adenoid condition If the lower lip protrudes prominently one may suspect an abnormal forward extension of the lower row of teeth or overgrowth of the mandible

The lip fold consists of a muscular base, chiefly the musculus orbicularis oris, and of glandular and adipose tissue Its outer layer is cutaneous, its inner one is mucomembranous The intervening red zone is called the transitional portion The boundary between the skin and red zone is sharp The color of the prominent transitional portion or vermilion area is a result of the rich vascular network contained in the high papillae of the connective tissue and of the only very slight cornification of the epithelium Occasionally sebaceous glands appearing as yellowish-white spots are found in this portion.

There is no distinct boundary between the red zone and the mucosa. The mucomembranous portion contains the typical labial glands of the mixed type and shows occasional single sebaceous glands The labial glands sometimes form minute projections which can be felt with the tongue.

The mucous portion of the lip extends to the base of the oral vestibule along the line of reflection which may be easily recognized by retracting the lips This line of reflection or fornix vestibuli, has also been called the "gutter" or mucogingival fold A special fold or attachment of the lip to the alveolar process is found in the midline (superior and inferior labial frena) The frenum of the upper lip is the more prominent. A diastema is present when the frenum extends between the central incisors across the alveolar ridge toward the incisal papilla of the hard palate. This condition, however is not common in adults More frequently an initial separation of the central incisors is reduced and obliterated as the permanent teeth erupt and move in an anterior and mesial direction.

Clinical Considerations

Cancer of the lip is the most common oral malignancy (46 59) Its behavior however is more closely related to cancer of the skin than

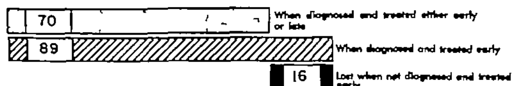


Fig. 37 —Percentage of five year cures of cancer of lip (See also Fig. 31 p. 90.)

to cancer of the oral mucous membrane proper Cancer of the lip like skin cancer can be diagnosed more easily than any other cancer The lesion is so conspicuously located that the patient and his friends should notice it soon after it begins Early diagnosis and treatment offer the best prognosis (Fig 37) Cancer of the lip is limited to squamous cell lesions which occur in the vermilion zone of the lower or the upper lip (Fig 38) About 95 per cent of lip cancers occur in the lower lip Chronic irritation (in a susceptible patient) from tobacco smoking (Fig 38 *E* and *F*) chemical or physical agents or the weather may play a role. Lip cancer may be found in an area of leuko-



FIG 38 —Squamous cell carcinoma of lip *A*, relatively early lesion of lower lip Note crust, which was removed with difficulty and left an ulcerated bleeding surface *B*, advanced lesion, indurated and fixed, of lower lip Note raised, rolled border No regional lymph nodes were palpable *C*, multicentric carcinomas of lower lip, each lesion appeared innocent Crusts were removed with difficulty Biopsy of four areas revealed high degree of malignancy *D*, carcinoma of upper lip, with secondary infection Lesions are much less common on upper lip than on the lower *E*, habitual pipe smoker *F*, same patient as preceding, with ulcerated area of lower lip corresponding to position of pipe stem Biopsy revealed carcinoma

plakia (Fig 24, p 73) It may be of occupational origin It is relatively rare in white women and Negroes

In the early clinical stages of cancer of the lip there may occur what appears to be an innocent looking blister or an induration which is so slight that it is difficult to detect As the growth increases in size and as ulceration develops the diagnosis becomes less difficult. Never-



FIG 39 —Anteroposterior section of mouth, showing carcinoma of lower lip and spread through lymphatics to regional lymph nodes Carcinoma of the lip metastasizes much later than that of the floor of the mouth or tongue

theless, cancer of the lip in the early clinical stage may be mistaken for either a cold sore or an innocuous fissure

Generally at later stages lip carcinoma, like many others can be classified into two groups according to the principal direction of growth (1) exophytic, and (2) endophytic.

The exophytic type of lip carcinoma (Fig 26 A p 75) although it does infiltrate and grow into the lip is characterized primarily by a prominent fungating growth, the surface of which is ulcerated and secondarily infected This type of carcinoma is described as outgrowing—growing toward the examiner and away from the patient. It is usually of a low degree of malignancy

Although the endophytic type of lip carcinoma (Figs 26 B and 38) does grow outward to a small extent, it is characterized primarily by

a relatively smaller, sharply punched-out ulcerative area with infiltration of the tumor into the depth of the lip This type is described as ingrowing—growing away from the examiner and toward the patient This smaller, less spectacular looking tumor is usually of a higher degree of malignancy than the exophytic type and consequently has a less favorable prognosis

Secondary infection, which appears late, is the cause of pain Metastases to the lymph nodes usually occur late if at all (Figs 39 and 40)

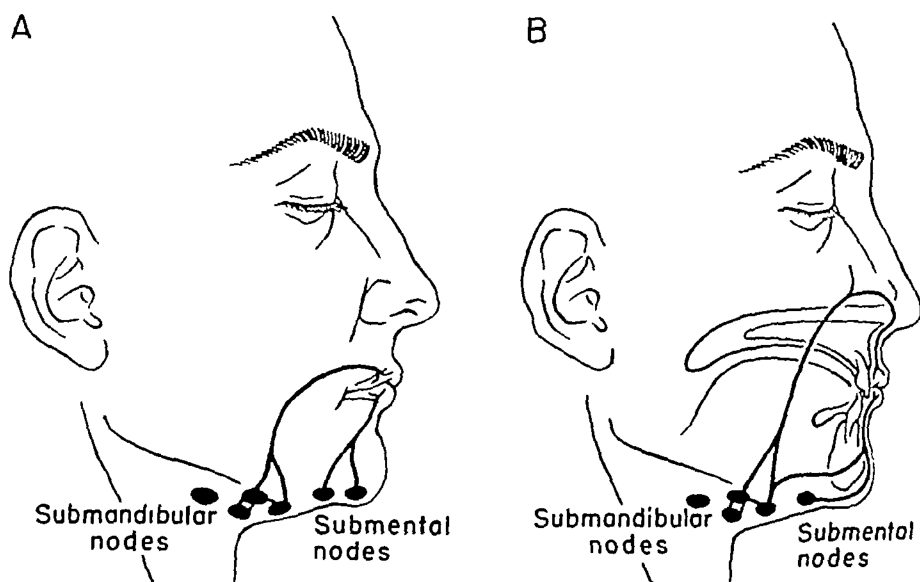


Fig 40 —Lymphatic drainage of the lips, path of spread of carcinoma to regional lymph nodes A, superficial, B, deep

Treatment and prognosis —Surgery and irradiation are the only accepted methods of treatment Local application of caustics is to be condemned Not only is it therapeutically valueless but it is irritating and, by giving the patient a temporary but false sense of security, postpones proper treatment Prognosis after treatment is better for carcinoma of the lip than for intraoral carcinoma (Fig 31, p 90). In spite of this, about 1 of every 100 tumor deaths may be traced to cancer of the lip.

Differential diagnosis —Carcinoma of the lip is a chronic, progressively growing, indurated or ulcerated condition which may be multicentric in origin (Fig 38, *C*) It should be differentiated readily from acute conditions such as herpes simplex (Fig 94, *A*, p 212), the chancre

of syphilis (Fig 94, *D*) and chronic conditions such as hyperkeratosis and leukoplakia.

CASE HISTORY

G B White man, aged 45

Chief complaint Sore on the lower lip for four weeks.

Onset and course Patient was perfectly well until about one month previously when a little sore developed on the red border of the left side of the lower lip This was soon covered by a crust. A few days later the crust was accidentally removed. There was a slight amount of bleeding. Soon another scab formed The process recurred several times. One morning while shaving the patient noticed that the sore seemed to have increased in size. It was not painful. That noon at lunch, an intimate friend asked what was the matter with his lip and had he seen a doctor The following week the patient sought professional advice

The patient smokes five to eight cigarets a day He is an enthusiastic sailor and spends many months of the year sailing. There is no history of cancer in the family

Physical examination A well developed, well nourished man of light complexion who is not acutely ill.

Regional examination On the left side of the lower lip about 1 cm. from the corner of the mouth adjacent to the skin border is a yellow brown crust measuring about 3 × 4 mm. This is removed fairly readily leaving an ulcerated bleeding surface. The border of the ulcer is raised, rolled, firm and irregular The base is indurated. Examination of the oral cavity reveals nothing significant. No submental, submandibular or cervical masses are palpable. The rest of the physical examination is negative

Tentative diagnosis Squamous cell carcinoma of the lower lip

Laboratory reports Biopsy—squamous cell carcinoma Serology—Wassermann and Kahn reactions negative.

Final diagnosis Squamous cell carcinoma of the lower lip

REMEMBER THAT THE INNOCENT LOOKING SMALL NODULE MAY BE A CANCER

XVI

Carcinoma of the Buccal Mucosa

Anatomic and Physiologic Considerations

The cheeks, like the lips, consist of an outer cutaneous, a middle muscular and an inner mucomembranous portion Powerful elastic fibers permit considerable stretching of the cheeks Small folds of the mucous portion are sometimes attached to the alveolar mucosa and form the buccal or lateral frena

The cheeks end posteriorly at the pterygomandibular fold which extends from the pterygoid hamulus to the posterior end of the lower alveolar process The opening of the parotid duct is found in the cheek opposite the upper second molar and is characterized by a small elevation, the parotid papilla (Figs 19, p. 66, and 84, *B*, p 200) The buccal glands are especially numerous in the molar region between the mucous membrane and the buccinator muscle

The buccinator muscle —This muscle forms the body of the cheeks and gives them an important role in guiding the eruption of the dentition and the normal position of the teeth The slight but constant pressure of the cheeks and lips on the molar and incisal regions of the arches is balanced by the opposing pressure of the tongue. A predominance of activity of one group of muscles over another results in corresponding deformities Thus, muscle training has become an important aid in combating malocclusion In mastication, the mucosa of the cheeks normally does not come between the molars since the lamina propria is strongly connected to the fascia

Buccal fat —A considerable pad of fat is found between the masseter and the buccinator muscle It is especially prominent in the infant, in whom it is believed to have had functional value during suckling It contains a high content of fatty acids, which dissolve slowly, and therefore during emaciation disappears later than the rest of the body fat

Clinical Considerations

Cancer of the buccal mucosa is frequently first discovered by the patient. The tip of the tongue is quite sensitive and is continually exploring the oral cavity and may detect a rough spot in the mouth early

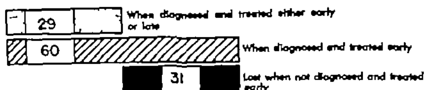


Fig. 41 —Percentage of five year cures of cancer of the cheek. (See also Fig 31 p 90)



Fig. 42 —Buccal carcinoma, first noted by patient six weeks previously Note, in contrast to smooth buccal mucosa, the ulcerated, irregular carcinoma and sharp raised, rolled border Diagnosis was confirmed on biopsy

The dentist who performs a complete oral examination including all the soft oral tissues of each of his patients is in a favorable position to make an early diagnosis and thus improve the chances of a cure (Fig 41)

Like other oral cancers that of the buccal mucosa is more common in the male than in the female. It usually occurs in the later decades of life, although it is not uncommon as early as the third decade. Although the surface of the tumor may be raised primarily it is frequently worn down by intraoral friction (Fig 42) Buccal carcinoma

and other tumors sometimes involve the papilla of the parotid duct (Fig 84, *B*, p 200) and occasionally are seen at its exit The lesion is painless until it becomes secondarily infected Early lesions are not painful Cancer of the buccal mucosa may also arise from pre-existing leukoplakia Sometimes there is a distinct white stripe in each cheek corresponding to the occlusal plane This is a result of dental trauma and is seldom proved to be leukoplakia upon microscopic examination

The dentist should contribute to cancer prevention by removing all

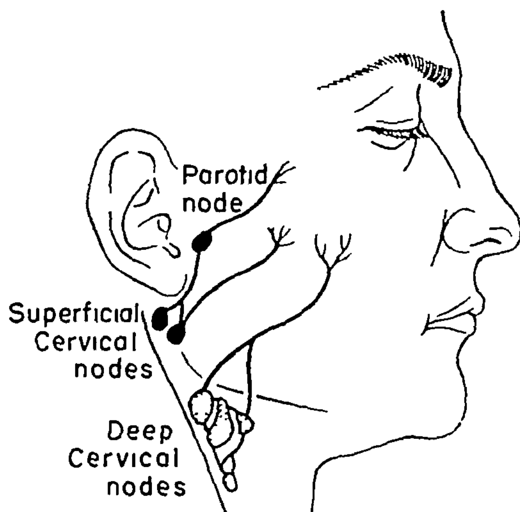


Fig 43 —Lymphatic drainage of the cheek, path of spread of carcinoma to regional lymph nodes

oral irritants such as jagged teeth and poorly fitting dentures and by improving oral hygiene The use of tobacco, particularly for chewing, may also play a role in the production of this type of cancer Buccal carcinoma may be occupational in origin

The prognosis for cancer of the buccal mucosa is not as favorable as for cancer of the lip Buccal cancer may extend to the lower and upper gingiva and palate and invade the bone (Fig 74, p 175) Secondary infection may involve the masseter and internal pterygoid muscles and cause trismus Metastases, although unilateral, occur earlier and in a greater percentage of patients than in cancer of the lip (Fig 43) Cancer of the buccal mucosa should be differentiated from aphthous stomatitis, ulceromembranous stomatitis, the lesions of syphilis and of tuberculosis and ulcers caused by trauma



PLATE I.—Cancerous lesions of the oral cavity *Top left* carcinoma of the floor of the mouth which has invaded the undersurface of the tongue. It is sometimes misdiagnosed as Vincent's infection. *Top right* carcinoma of lateral and inferior surfaces of the tongue. The entire tongue should be examined carefully for what may appear to be innocuous fissures and ulcerations. *Center left* carcinoma of the palatal mucosa. It is sometimes discovered by the patient because the upper denture does not fit. The palatal bone is usually invaded early *Center right* osteogenic sarcoma of the maxilla, diagnosed early The tooth felt "high" on chewing, and the dentist took a biopsy of surrounding tissue. Note swelling and irregularity of gingiva of upper bicuspid. *Bottom left* carcinoma of the gingiva in retromolar area. Patients with gingival lesions usually consult the dentist first. *Bottom right* carcinoma of the maxillary sinus with extension into oral cavity It is sometimes misdiagnosed as cancer of the gingiva.

CASE HISTORY

M S White man, aged 50

Chief complaint Sore inside right cheek of two months duration.

Onset and course Patient had a rough, badly decayed lower right first molar that frequently irritated the cheek while eating and caused a sore About two months previously he had seen his dentist, who said the tooth could not be saved and extracted it. The sore did not heal Subsequent applications of gentian violet and other drugs were of no avail. The sore became larger and painful.

Physical examination A well developed, fairly well nourished man

Regional examination On the right buccal surface corresponding to the first molar area is a 1 5 × 2 0 cm ulcerated area, tender to palpation. The base is firm and indurated and the surface irregular There are many small raised areas, some of which have a shaggy gray covering and others a dull, red appearance This is in contrast to the glistening and smooth redness of the surrounding mucous membrane. The border is firm, raised and irregular In the right submandibular region a stony-hard mass is palpable. It is moderately fixed, 2 × 1 × 1 cm. in size and egg shaped. No similar mass is palpable in the left submental, submandibular or cervical regions. Complete oral examination reveals "poor oral hygiene," and absence of the right lower first molar

Tentative diagnosis Squamous cell carcinoma of the right buccal mucosa with probable metastasis to the right submandibular lymph node

Laboratory reports Biopsy—squamous cell carcinoma with inflammatory cells present. Serology—Wassermann and Kahn reactions negative

Final diagnosis Squamous cell carcinoma of the right buccal mucosa with secondary infection and metastasis to the right submandibular lymph node.

IT IS GOOD DENTAL PRACTICE TO ELIMINATE ORAL IRRITATION PRODUCED BY TEETH OR RESTORATIONS

XVII

Carcinoma of the Floor of the Mouth

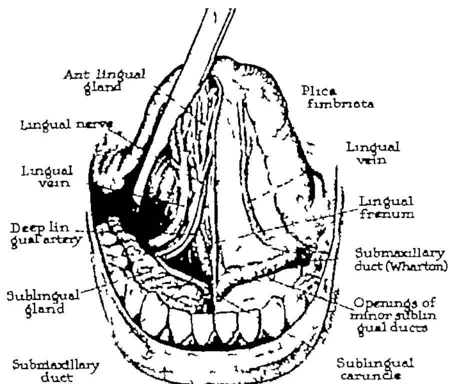
Anatomic and Physiologic Considerations

The mylohyoid muscle forms the muscular floor of the mouth The horseshoe-shaped sublingual region at the floor of the mouth is readily seen when the tongue is raised (Fig 44) The peripheral boundaries are formed by the lingual aspect of the mandible, and the inner boundary is formed by the attachment of the tongue

The floor of the oral cavity is covered by a thin, highly vascular mucous membrane which is covered with stratified squamous epithelium Many small mucous glands are distributed throughout the membrane The floor is incompletely divided in the midline by a fold of the mucous membrane, the lingual frenum On each side is a small nodule, the salivary caruncle, in the center of which is the opening of the duct of the submandibular and major sublingual salivary glands Lateral to this, along an irregular granulated elevation caused by the sublingual gland, are the openings of the ducts of the minor sublingual glands (Fig 44)

Clinical Considerations

Carcinoma of the floor of the mouth is frequently discovered as an induration which is felt by the tip of the tongue As the lesion ulcerates and grows larger or invades the frenum of the tongue (Fig 46), pain, particularly on movement of the tongue, may become prominent Cancer of the floor of the mouth frequently grows peripherally to invade the mandible by direct extension (Fig 74, p 175), or it may grow centrally to the under surface of the tongue (Plate I, frontispiece, top left) Not infrequently cancer of the inferior surface of the tongue is continuous with that of the floor of the mouth Many cancers of the



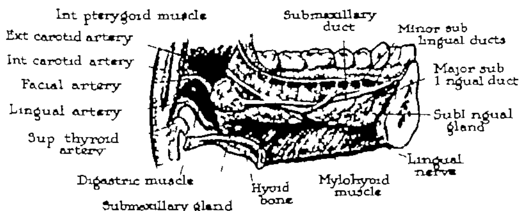


FIG. 44.—Floor of the mouth. (From Massler M and Schour I *Atlas of the Mouth* [Chicago American Dental Association, 1948])

floor of the mouth tend to invade the lymphatics early and spread to the neck (Fig 47) The prognosis is among the poorest of all malignant conditions of the oral cavity (Fig 31, p 90)

Watchful waiting, incorrect diagnosis and incorrect treatment all doom many patients who otherwise might have had a chance of survival (Fig 45) A biopsy should always be made whether or not the diagnosis is in doubt It is better to prove a benign lesion than to miss

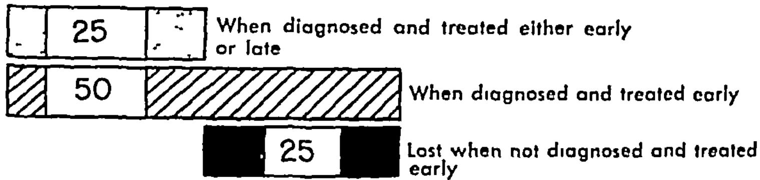


FIG 45 —Percentage of five year cures of cancer of the floor of the mouth (See also Fig 31, p 90)



FIG 46 —Carcinoma of the floor of the mouth which has invaded the lingual frenum Compare the irregular, raised, ulcerated area on the left with the smooth area on the right Since this is often associated with Vincent's infection, the more crucial diagnosis of carcinoma is sometimes overlooked

a cancer An infiltrative cancer of the floor of the mouth is sometimes diagnosed first as Vincent's infection A smear is taken and an incorrect diagnosis is based on the finding of fusiform bacilli and spirochetes that are regular inhabitants of the oral cavity The cancer is then mistreated with dyes, oxidizing agents, antibiotics and caustics It is true that cancer of the mouth is frequently secondarily infected, but the primary aim is to treat the cancer

Other conditions besides Vincent's infection (Fig 95, p 213) to be considered in the differential diagnosis are swelling of the submandibular or sublingual ducts and their glands following obstruction, chronic

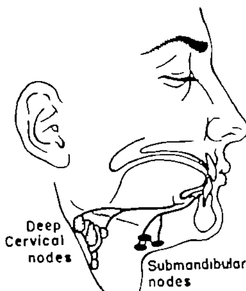


FIG. 47 —Lymphatic drainage of the floor of the mouth, path of spread of carcinoma to regional lymph nodes

inflammation, benign tumors which are rare and calculi. The ranula (Fig 82, A, p 199) a mucous gland cyst found in the floor of the mouth, should offer no difficulty in diagnosis

CASE HISTORY

L. K White man, aged 58

Chief complaint Sore mouth of three months duration

Onset and course About three months previously the patient found that he could no longer smoke his pipe all day long because his mouth would become sore He also noted that although the pain was less severe when he was not smoking it was nevertheless, constantly present. Because of this, he had difficulty in eating A dentist diagnosed "Vincent's infection" after bacteriologic examination, painted the lesion with gentian violet and prescribed penicillin lozenges and vitamin B complex. After several treatments the pain decreased but the sore did not heal. Three weeks ago the dentist cut out a little piece of the suspicious tissue and had it examined under the microscope The patient continued smoking to the present.

Physical examination A well developed but only fairly well nourished and slightly dehydrated man with a sweetish odor to the breath.

Regional examination The right side of the floor of the mouth has an irregular ulcer about 1.5×2 cm which extends onto the undersurface of the tongue. The base is firm, granular and has a reddish appearance. The gingiva is red and swollen The upper and lower lateral incisors and cuspids on the right side are worn to accommodate the pipe stem. The right submandibular region shows a firm, fixed mass about $1 \times 2 \times 0.5$ cm It is not tender to palpation. There are no other significant findings.

Tentative diagnosis (1) Squamous cell carcinoma of the floor of the mouth with probable metastasis to right submandibular lymph node (2) Diabetes mellitus (?)

Laboratory reports Biopsy—squamous cell carcinoma Serology—Wassermann and Kahn reactions negative Urine—positive for sugar and acetone Roentgenogram—no evidence of destruction of the mandible

Final diagnosis (1) Squamous cell carcinoma of the floor of the mouth with metastasis to right submandibular lymph node (2) Diabetes mellitus with acidosis

REMEMBER THAT THE PATIENT WITH CANCER MAY HAVE OTHER ILLNESSES TOO

XVIII

Carcinoma of the Tongue

Anatomic and Physiologic Considerations

The tongue fills the closed oral cavity more or less completely (Fig 12, p 49) It is a mass of voluntary muscle fibers arranged in interlacing bundles designed to permit great freedom of movement. Its functions are related to ingestion and speech.

The tongue consists of the free pointed tip the body and the base or root. The V shaped arrangement of the circumvallate papillae marks the boundary line between the body and the root (Fig 48) The base, which faces the pharynx assumes an almost vertical plane in contrast to the body which assumes a horizontal position. The most striking characteristics of the tongue are its musculature and the specialized papillae that are found on the dorsal surface

Muscles of the tongue —These consist of the extrinsic and intrinsic groups The extrinsic muscles are inserted on the styloid process mandible and hyoid bone and permit the movement of the tongue in all directions except elevation. They are paired and comprised of the styloglossus genioglossus and hyoglossus

The intrinsic muscles constitute the lingual muscles and permit change of the shape of the tongue to different forms A frontal section through the body of the tongue in the central portion shows a network of muscle fibers which run chiefly longitudinally but also transversely and vertically

Papillae —The superior or dorsal surface of the body of the tongue is roughened by papillary projections These are comprised of the many filiform and fungiform and the fewer circumvallate papillae (Fig 48) The filiform papillae appear somewhat grayish because their thick epithelium does not permit the blood supply of the connective tissue to shine through. The fungiform papillae are found espe-

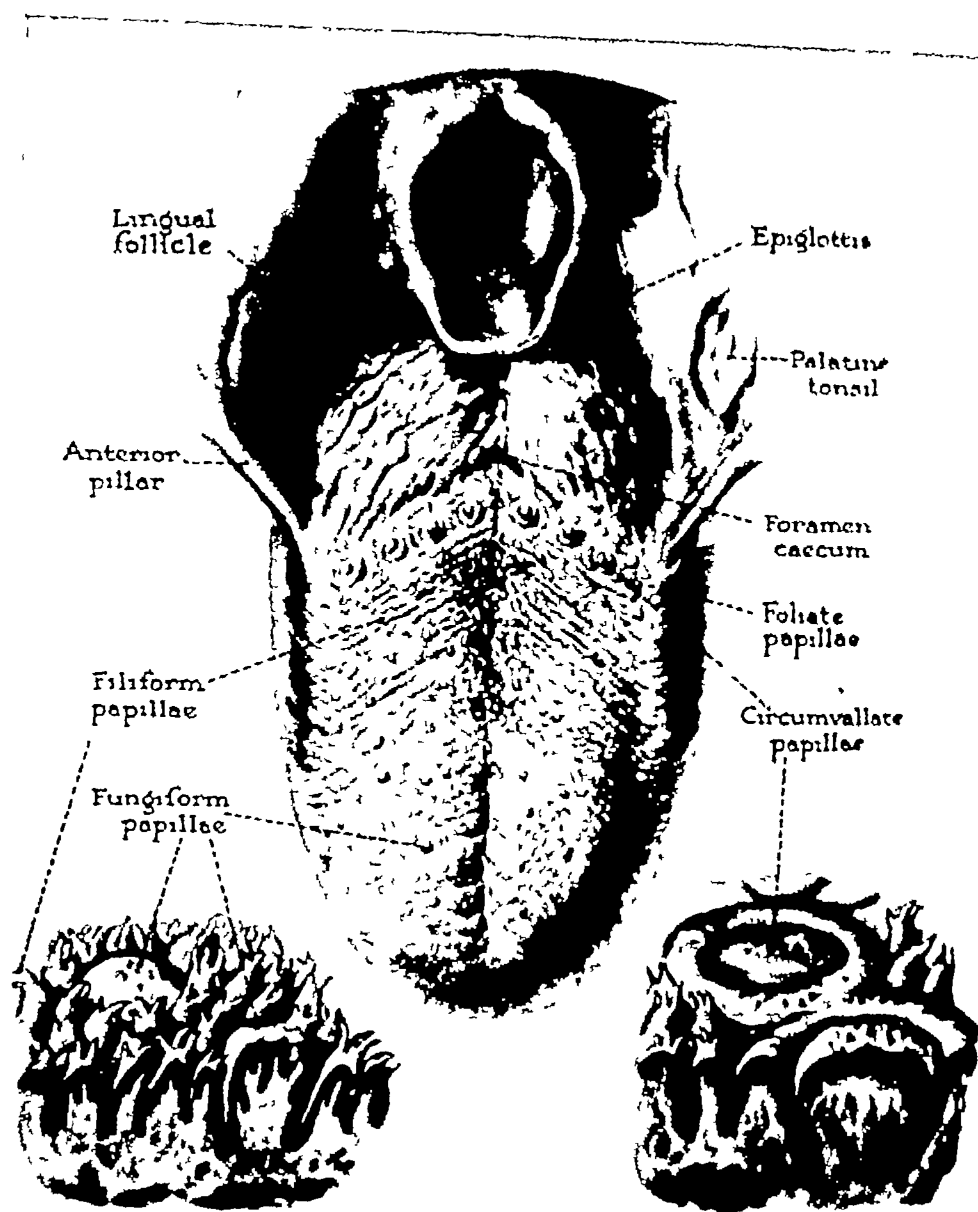


FIG 48—Dorsum of the tongue (Modified from Massler, M , and Schour, I *Atlas of the Mouth* [Chicago American Dental Association, 1948])

cially near the edges of the tongue They appear as red points because of the thinness of their epithelium The variably developed foliate papillae are seen on the posterolateral margin of the tongue The dif ferences in the epithelial cover of the papillae account for the distinct pathologic manifestations seen in the tongue in particular diseases

Taste buds—The taste buds are found chiefly on the walls of the

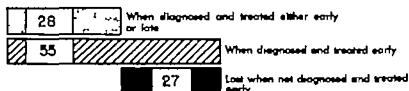


FIG. 49—Percentage of five year cures of cancer of the tongue (See also Fig. 31 p. 90)

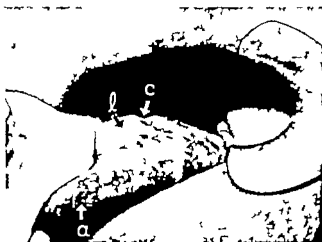


FIG. 50—Syphilitic glossitis, leukoplakia and carcinoma of the tongue. Note smooth lateral margin of the tongue, with, *a*, atrophy of papillae *l*, raised, thick ened, whitish areas of leukoplakia, *c*, ulcerated area of leukoplakia which on biopsy proved to be carcinoma.

circumvallate papillae which are the largest of the tongue papillae. They are always found in the epithelium of the fungiform papillae of the anterior third of the tongue Occasionally they are found in the soft palate and on the posterior surface of the epiglottis

Lingual tonsil.—The base of the tongue between the circumvallate papillae and the epiglottis is studded with either oval or rounded low prominences These elevations are caused by the accumulation of lymphoid tissue and are known as lingual follicles The sum total of follicles constitutes the lingual tonsil (Fig 48) In the center of each

follicle is a deep depression forming a blind pouch, known as the lingual crypt This is lined with stratified squamous epithelium like that of the adjoining mucous membrane, and into the bottom of the crypt open the ducts of small mixed glands

Inferior surface—The inferior surface of the tongue is smooth and free of papillae It is attached in the midline to the floor of the mouth by a sagittal fold, the lingual frenum The tongue-tied condition is said to occur when this band extends too far anteriorly toward the tip of



FIG 51—Advanced carcinoma of lateral portion of tongue Note raised border and central cavitation as result of tissue necrosis Usually this type is even farther advanced than clinical examination indicates Firm, painless masses are palpable in the submandibular and cervical regions

the tongue The frenum is sometimes so taut that it interferes with suckling and speech Two fimbriated folds course from the anterior end of the lingual frenum posteriorly and parallel to the margin of the tongue (Fig 44, p 127)

CLINICAL CONSIDERATIONS

The various portions of the tongue present different anatomic characteristics The anatomic location of tongue cancer is therefore an important factor in treatment and prognosis The following regions must be considered (1) anterior portion (freely movable) (2) middle portion, (3) posterior or basal portion (posterior to circumvallate papillae)

The dorsal, lateral and inferior surfaces may be involved (Plate I top right) On the dorsum leukoplakia is sometimes seen (Figs 50 and 70 A, p 168) In such instances multiple broad flat areas of induration may be observed. Poor oral hygiene and sharp jagged and mal



FIG. 52.—Fissure type carcinoma at junction of lateral base of the tongue and anterior tonsillar pillar The patient first noted a mass below the angle of the jaw (insert) An innocent looking fissure was evident only when the examiner extended the tongue. Biopsy disclosed a high degree of malignancy

posed teeth are frequently associated with cancer of the tongue Many cancers of the tongue invade the floor of the mouth and thus immobilize the tongue. Sometimes it is impossible to determine whether the lesion arose on the inferior surface of the tongue or on the floor of the mouth (Plate I top left) These are advanced cases for which the prognosis is poor Generally the farther back the oral cancer is on the

tongue, the more malignant and the less amenable it is to treatment Early diagnosis and proper treatment are most essential (Fig. 49) (62)

Syphilitic glossitis —Patients with syphilitic glossitis have a high incidence of cancer of the tongue (Fig 50) Therefore, a lesion on the tongue in a syphilitic individual should be suspected of being malignant first, and the diagnosis should be verified immediately by biopsy

Examination —A careful and thorough examination of the tongue should include not only inspection but palpation In addition to grasp

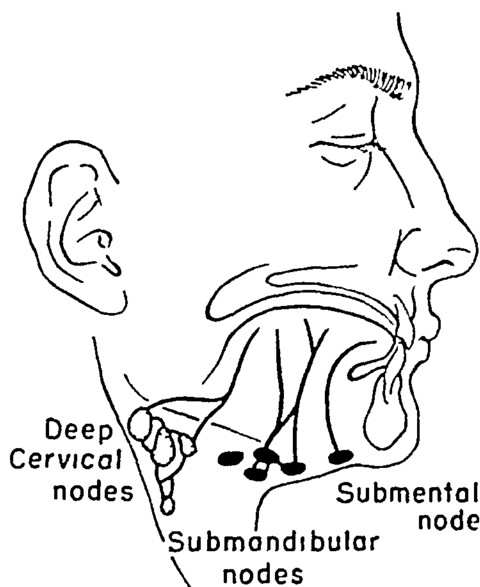


FIG 53 —Lymphatic drainage of the tongue, path of spread of carcinoma to regional lymph nodes There may be cross-metastases

ing the tip of the tongue with gauze and pulling it forward (Fig. 20, p 67), thereby bringing the base forward, the posterior portion should be examined with the dental mirror and by digital examination with the gloved finger The invasion of the tongue is usually considerably more widespread than such an examination will reveal (Fig 51). Diagnosis of early carcinoma of the tongue is frequently missed because of its innocent appearance

Classification —Generally cancer of the tongue is of either the endophytic (infiltrative, ulcerative) type or the exophytic (papillary, fungating) type A fissure type occurring between the lateral base of the tongue and the anterior tonsillar pillar is often missed (Fig 52). The junction of the pillar and the base of the tongue should therefore be

examined with great care. One of the earliest complaints of the patient may be of referred pain to the ear or of a mass in the neck (Figs 52 and 53)

Differential diagnosis—Carcinoma of the tongue must be differentiated from certain other lesions Some of the acute lesions to be con sidered are the ulcers of aphthous stomatitis, ulceromembranous stomatitis and the mucous patch (Fig 93 *E* p 211) Chronic lesions that must be kept in mind are the traumatic ulcer (Fig 70 *D* p 166) tuberculous ulcer (Fig 93 *F*) the ulcers and fissures associated with leukoplakia, the gumma and hairy tongue (Fig 93 *A*) median rhomboid glossitis (Fig 93 *B*) and geographic tongue (Fig 93, *C* and *D*) The foliate papillae on the posterolateral margin of the tongue are normal structures and should not be mistaken for abnormal lesions (Fig 48 p 132)

CASE HISTORY

F O White man, aged 58

Chief complaint Edentulous upper jaw for one month

Onset and course The patient visited his dentist to obtain an upper denture. On routine examination of the mouth, the dentist discovered a sore on the back of the tongue just to the left of the midline The patient had had no symptoms and was totally unaware of the condition The physician to whom the patient was referred took a biopsy The microscopic report stated that no evidence of carcinoma was seen. The Wassermann reaction of the blood was positive. A second biopsy was taken a week later

Physical examination A fairly well developed and nourished man who is not acutely ill.

Regional examination Intraoral findings are limited essentially to the tongue On the dorsal surface just anterior to the circumvallate papillae and to the left of the midline is a shallow irregularly shaped ulcer approximately 4 × 3 mm. The borders are sharply demarcated. The surface is finely granular and dull red There is no tenderness to palpation. The base seems to be moderatley indurated. There are no significant findings in the face, submandibular submental and cervical regions

Tentative diagnosis Squamous cell carcinoma of the tongue

Laboratory reports Biopsy—squamous cell carcinoma. Serology—Kahn and Wassermann reactions positive.

Final diagnosis (1) Squamous cell carcinoma of the tongue, middle third of dorsum. (2) Late syphilis.

IN THE TONGUE CANCER IS FREQUENTLY ASSOCIATED WITH SYPHILIS

XIX

Carcinoma of the Palate

Anatomic and Physiologic Considerations

THE PALATE consists of the anterior hard palate, with its bony base and the movable posterior soft palate (Figs 11, p 48, 21, *A*, p 68, 33, p 104, 62, p 151). The hard palate forms the roof of the oral cavity as well as the floor of the nasal cavity The soft palate, because of its oblique position and its action, forms both part of the roof and the posterior wall of the oral cavity The palatal vault varies in both width and height

The hard palate.—The hard palate is characterized by the mesial papilla which is situated in the midline immediately behind the two central incisors and covering the incisive foramen The median raphe extends from the posterior end of the hard palate to the mesial papilla Occasionally a bony elevation is seen in the midline, the torus palatinus (Fig 91, *B*, p 208)

PALATAL RUGAE —The palatine rugae, five or six transverse folds, are found on the anterior part of the hard palate They vary in prominence in different individuals and at different ages They are well developed in the newborn, when they may have a mechanical function in suckling and are flatter in the adult The rugae are well supplied with tactile nerves

Epithelial pearls similar to those found in the gingiva are present in the newborn in the lamina propria of the midregion. They are remnants of the epithelium that fused during closure of the palate and disappear later except for occasional epithelial strands These may give rise to cysts in the adult

REGIONAL CHARACTERISTICS —Four regions have been distinguished in the hard palate on the basis of the structural characteristics of the mucosa. In the raphe and near the alveolar process the lamina propria

is directly attached to the periosteum without intervening submucosa. These are the fibrous median and marginal zones In the areas between these regions is a layer of submucosa which contains considerable adi pose tissue in the anterior portion (fat tissue zone) and many mucous glands in the posterior portion of the hard palate (glandular zone)

The soft palate —The boundary between the hard and the soft palate can be recognized by the difference in color and mobility The mucosa is pale red in the hard palate and more deeply red in the soft palate The latter also shows a yellowish tinge which it derives from the under lying glands.

The soft palate consists of a muscle base covered by respiratory mucosa (with ciliated columnar epithelium) on its nasal surface and oral mucosa (with stratified squamous epithelium) on its inferior surface The oral surface has a relatively thin lamina propria which

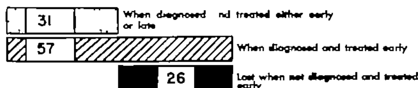


Fig 54 —Percentage of five year cures of carcinoma of the palate. (See also Fig 31, p. 90)

contains scattered lymphocytes The submucosa is continuous with the perimysium It contains coarse connective tissue bundles, strong elastic fibers and a considerable amount of glandular and adipose tissue. The tip of the uvula has a rich blood and lymph supply and a loose texture of its connective tissue. This helps to explain the edema which often has rapid onset in the uvula. The free margin of the soft palate branches laterally into two folds the palatoglossal and the palato-pharyngeal arches *which diverge and enclose the palatine tonsils.*

Clinical Considerations

Cancer may be found in the mucosa of either the hard or the soft palate It may also extend over both hard and soft palates either from the tonsillar pillars or from the nasal side of the palate through to the oral surface of the palate In addition to local spread, it extends via the lymphatics (Fig 55) The prognosis is best when diagnosis is made early and proper treatment is given.

Carcinoma of the palate is usually of a squamous cell type but is

XIX

Carcinoma of the Palate

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is directly attached to the periosteum without intervening submucosa. These are the fibrous median and marginal zones In the areas between these regions is a layer of submucosa which contains considerable adipose tissue in the anterior portion (fat tissue zone) and many mucous glands in the posterior portion of the hard palate (glandular zone)

The soft palate —The boundary between the hard and the soft palate can be recognized by the difference in color and mobility The mucosa is pale red in the hard palate and more deeply red in the soft palate The latter also shows a yellowish tinge which it derives from the underlying glands

The soft palate consists of a muscle base covered by respiratory mucosa (with ciliated columnar epithelium) on its nasal surface and oral mucosa (with stratified squamous epithelium) on its inferior surface The oral surface has a relatively thin lamina propria which

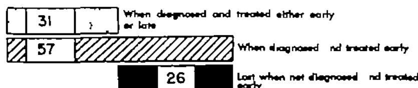


FIG. 54 —Percentage of five year cures of carcinoma of the palate (See also Fig 31 p 90)

contains scattered lymphocytes The submucosa is continuous with the perimysium It contains coarse connective tissue bundles, strong elastic fibers and a considerable amount of glandular and adipose tissue. The tip of the uvula has a rich blood and lymph supply and a loose texture of its connective tissue. This helps to explain the edema which often has rapid onset in the uvula The free margin of the soft palate branches laterally into two folds the palatoglossal and the palatopharyngeal arches which diverge and enclose the palatine tonsils

CLINICAL CONSIDERATIONS

Cancer may be found in the mucosa of either the hard or the soft palate It may also extend over both hard and soft palates either from the tonsillar pillars or from the nasal side of the palate through to the oral surface of the palate In addition to local spread it extends via the lymphatics (Fig 55) The prognosis is best when diagnosis is made early and proper treatment is given.

Carcinoma of the palate is usually of a squamous cell type but is

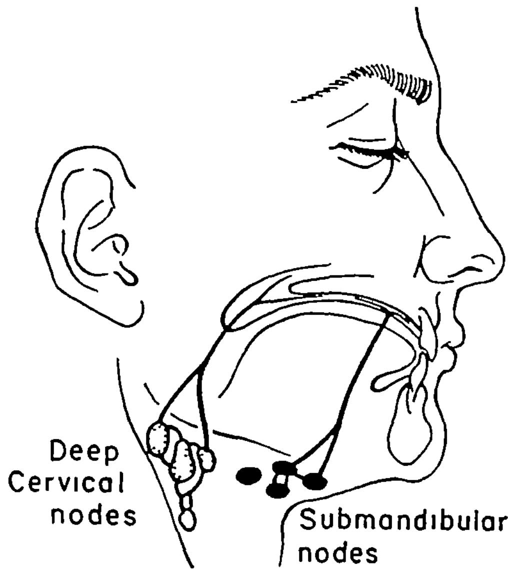


FIG 55—Lymphatic drainage of the palate, path of spread of carcinoma to regional lymph nodes



FIG 56—Adenocarcinoma of the palate Note elevated border and central area of ulceration and necrosis The patient had difficulty in talking and eating, the chief complaint was that of bleeding from the wound

sometimes glandular The gross characteristic may be a sharply punched-out, shallow and irregular ulcer (Plate I, frontispiece, center left), a papillary or wartlike growth with a wide base, or a mass which may eventually ulcerate (Fig 56)

Mixed tumors—In addition to the common epithelial cancers of the mouth, there is a considerable variety of tumors which are often encountered by the dentist Mixed tumors of the minor salivary glands (palatine) appear on the hard and soft palate and form slowly growing,

solid and generally protruding masses which have little tendency to ulcerate (Fig 64, p 154) They are frequently but not always found in the midline. Although it is often impossible to decide whether these tumors are benign or malignant by microscopic examination, they should be removed completely If a few cells are left behind the growth will continue and, if initially benign, the tumor may subsequently un dergo malignant change. The mixed tumor must be considered in the differential diagnosis of tumors of the palate (see Chap XXII) Other conditions to be considered in the differential diagnosis are torus pala tinus (Fig 91 *B* p 208 and Plate II, facing p 197 top left) papilloma, reactions of the palatal mucosa to an upper denture, abscess (Fig 91 *C*) dental cysts of the bone and the spread of tumors from adjacent areas Mixed tumors have been referred to as pleomorphic adenomas

CASE HISTORY

A. H White man, aged 47

Chief complaint Inability to wear upper denture for one month.

Onset and course Patient has been wearing an upper denture for two years. It fitted well and had not been troublesome until about one month previously At that time he noted that the denture did not fit as well as in the past. This became worse One evening, after taking the denture out at bedtime, the patient looked in his mouth and noted some sort of growth on the hard palate. The next morning he saw the dentist who had made the denture. The patient was advised not to wear the denture and was immediately referred to an oral surgeon.

Physical examination This reveals a well developed and well nourished man who does not appear acutely ill.

Regional examination The hard palate shows an irregularly shaped, papil lary wartlike gray mass about 9 × 4 × 3 mm. The mass is firm and fixed and situated in the midline about 2 cm. behind the anterior maxillary ridge. It is not tender to palpation. Ulceration is not evident. Complete intraoral examination reveals nothing significant except that the maxilla is edentulous. No submandibular submental or cervical nodes are palpable. A sample of blood has been drawn and a biopsy performed.

Tentative diagnosis Squamous cell carcinoma of the mucosa of the hard palate.

Laboratory reports Biopsy—squamous cell carcinoma. Serology—blood Wassermann and Kahn reactions negative. Roentgenogram—no evidence of destruction of the hard palate

Final diagnosis Squamous cell carcinoma of the mucosa of the hard palate with probable invasion of the bony palate.

INABILITY TO WEAR AN UPPER DENTURE MAY BE THE FIRST SYMPTOM OF CANCER OF THE PALATE

XX

Carcinoma of the Gingiva and Retromolar Area

Anatomic and Physiologic Considerations

The gingiva constitutes that portion of the oral mucosa which rests on bone, chiefly alveolar bone (Fig 13, p 53) Its attachment to the underlying bone and its protection by a superficial cornified layer of epithelium gives it a firm resistant texture The color is an opaque pink in contrast to that of the oral mucosa, which is a translucent red. The rich capillaries of the gingiva are not readily seen because of the presence of the opaque corneated layer of epithelium

The sensory nerve supply of the gingiva is limited Injuries to the gingiva are therefore relatively painless and are often neglected They heal more readily than do similar injuries elsewhere owing to their high vascularity and the bacteriostatic quality of the saliva

The gingiva has rightly been called an indicator of oral health and disease It is exposed to chronic irritation more than any other portion of the oral cavity and is therefore in a state of chronic inflammation This subclinical state of inflammation is associated with the presence of many lymphocytes and plasma cells in the connective tissue and is so common that it may be regarded as characteristic of the gingiva

The gingival crevice which arises during the separation of the gingival epithelium and the tooth coincident with the continuous eruption of the tooth is an especially vulnerable region This favors the formation of a pocket and consequent development of regressive injuries to the investing and supporting dental structures

Pigmentation of the gingiva is normal, especially in the Negro This is characterized by the endogenous brown melanin Pigmented tumors, benign and malignant, may occur in the gingiva These should be dis-

tinguished from other pigmentations such as the lead and bismuth lines which follow systemic treatment. Coal and metallic dusts which accumulate locally on the surface or penetrate into various levels of the epithelium and sometimes even into the connective tissue are ex ogenous pigments Sometimes a blue-black area of pigmentation in the soft oral tissues may be the result of the inadvertent insertion of dental silver amalgam Bleeding gingiva may act as an indicator not only of a local but of a systemic disease (Fig 68 p 161)

Clinical Considerations

Cancer of the gingiva and retromolar area (Plate I frontispiece bottom left) should be recognized early because it is accessible and may be traumatized by the toothbrush, resulting in secondary infection

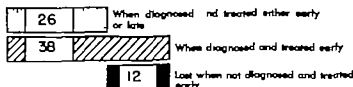


Fig. 57 –Percentage of five year cures of carcinoma of the gingiva (See also Fig. 31, p 90)

and pain (70) If the infection spreads to the muscles of mastication, trismus may result. The melanoma (benign or malignant) carcinoma of the maxillary sinus (Fig 77 *B* p 183) tuberculosis, syphilis periph eral giant cell tumor (Fig 92, p 209) osteosarcoma (Plate I center right) and lesions due to trauma should also be considered Sometimes a carcinoma of the gingiva is incised because of the mistaken diagnosis of subperiosteal abscess Any growth, however should be considered to be cancer until proved otherwise. Cancer of the gingiva may spread to bone (Fig 74, p 175) and the lymphatics (Fig 58)

It must be pointed out that microscopically inflammatory (Fig 69 A) and neoplastic (Fig 69 *B*) changes in the gingiva may be confused and an incorrect diagnosis made An improper plane of section may also be misleading

Loose teeth.–Carcinoma of the gingiva usually arises in the molar and bicuspid region, seldom in the anterior part of the mouth. Oc casionally growths of the gingiva are seen along the posterior teeth which support the clasps of partial dentures The clasps may be a

source of irritation, and the denture should not be worn until a diagnosis is made and adequate treatment instituted Sometimes the clasped or supporting tooth becomes loose because of invasion of both the alveolar bone and the jaw bone by the tumor Such loose teeth should not be extracted until the specialist who will treat the patient has been consulted Premature extraction of such teeth may only open another pathway of spread for the cancer

Invasion of bone—Cancer of the gingiva may invade bone early Once carcinoma has invaded bone, treatment is more difficult and less

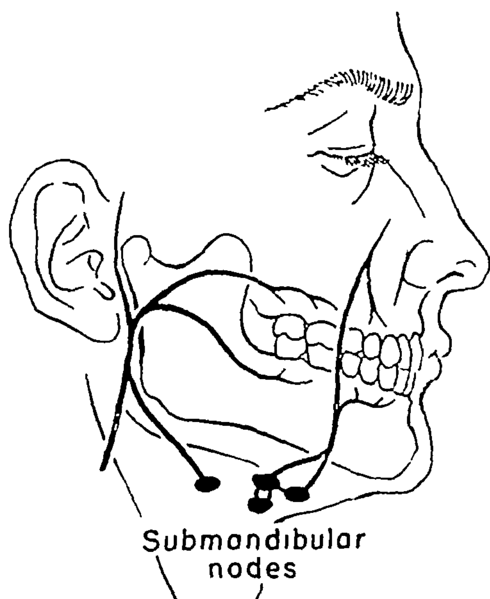


FIG 58—Lymphatic drainage of the gingiva, path of spread of carcinoma to regional lymph nodes

satisfactory Therefore early diagnosis is essential for the most favorable prognosis (Fig 57) Negative roentgenographic findings, however, should not give one a feeling of security Often the bony tissue has been invaded and eroded to an unexpected extent even when there is no roentgenographic evidence of it In the absence of a characteristic surface tumor, the bone changes on the roentgenogram may be ascribed, in error, to chronic osteomyelitis

CASE HISTORY

K L White man, aged 41

Chief complaint Loose tooth for one month

Onset and course Patient has been wearing an upper partial denture for

six years. About one month previously he noted that the upper right first bicuspid, which is one of the clasped teeth, was a little loose Since then the tooth has become progressively looser and a small growth has been noted along the back of the tooth Clinical and roentgenographic examination by a dentist two weeks ago showed no disturbance in the attachment apparatus of the tooth. The other supporting teeth were firm The patient was instructed not to wear his denture. In the ensuing two weeks the growth has become larger and the tooth looser

Physical examination A well developed, well nourished man who is not acutely ill.

Regional examination The breath is moderately foul Several of the maxillary teeth are absent A firm, fixed, ulcerated, gray red nodular mass 4 × 6 × 3 mm. is present on the buccal gingival border distal to the upper right first bicuspid It is tender to palpation The tooth has more than the usual amount of mobility and is not as firmly attached as the remaining teeth No submandibular submental or cervical nodes are palpable A sample of blood has been drawn, a biopsy performed and intraoral and extraoral roentgenograms of the area taken.

Tentative diagnosis Squamous cell carcinoma, upper right gingiva, with probable invasion of the maxilla. Rule out carcinoma of maxillary sinus

Laboratory reports Biopsy—squamous cell carcinoma Serology—Kahn and Wassermann reactions positive Roentgenogram—no evidence of bone destruction.

Final diagnosis (1) Squamous cell carcinoma of the upper right gingiva (buccal bicuspid area) with invasion of maxilla (2) Syphilis.

MOST PATIENTS WITH CANCER OF THE GINGIVA CONSULT THE DENTIST FIRST

XXI

Cancer of the Tonsil

Anatomic and Physiologic Considerations

The palatine tonsils are paired lymphoid organs, each situated on the lateral walls of the fauces between the anterior and posterior pillars of the soft palate (Fig 59, see also Fig 11, p 48) They are at the junction of the oral cavity proper and the oral pharynx With the nasopharyngeal tonsil (adenoid), the lymph follicles on the posterior pharyngeal wall and the lingual tonsil, they constitute a lymphatic ring (Fig 59) The palatine tonsils are rich in lymphatics which drain along the lateral wall of the pharynx down into the deep cervical nodes (Fig 60)

Clinical Considerations

Patients with cancer of the tonsil may be seen first by the dentist It is found most frequently in men in the fifth decade About 10 per cent of tonsillar cancer occurs in women It is proliferative and produces a mass which may attain large size and may become superficially ulcerated The ulceration may be covered with a white exudate resembling that of a Vincent's infection or of diphtheria. Invasion of the posterior pillar is rarely observed, but extension to the anterior or glossopalatine pillar is common Metastases to an upper cervical node are common and the spread may be to the lower neck and, by retrograde invasion, to the axilla and mediastinum

Classification —Generally, two groups of cancer of the tonsil may be considered The first is the squamous cell carcinoma which does not become large and is superficially ulcerated The other group is of lymphoid origin and occurs more often in women in the third and fourth decades than in men It attains a large size, seldom ulcerates

and tends to metastasize earlier and more extensively than the squamous cell type Tonsillar cancers develop insidiously metastasize rapidly and are very radiosensitive.

Secondary tumors —A considerable group of tonsillar tumors thought

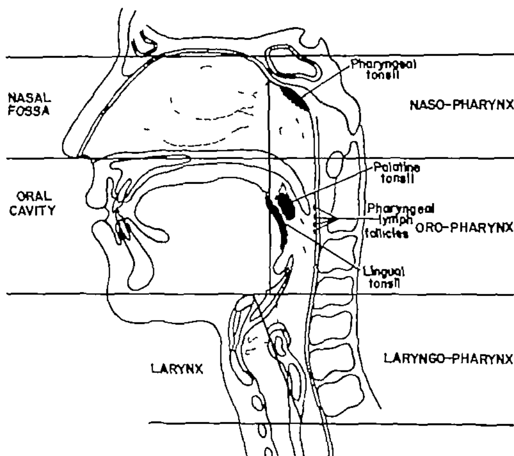


FIG. 59 —Midsagittal section of the head showing nasal, oral and laryngeal zones of the pharynx and component tonsils and follicles of the lymphatic ring. (Adapted from Ackerman, L V., and del Regato J A. Cancer [St. Louis C. V Mosby Company 1954])

to be primary in the tonsils actually originates in the anterior or posterior faucial pillars From there they early invade the tonsillar fossa and then resemble primary tonsillar tumors This group of secondary tumors usually belongs to the squamous cell type They do not metastasize as rapidly but are more radioresistant than the primary tumors

Symptoms —The early clinical symptoms are a sore throat or a sensation in the throat of a foreign body accompanied or followed by

slight pain on swallowing Earache or pain in the tonsillar region seldom occurs early If the tumor becomes large, swallowing and breathing may be difficult If there is secondary infection the patient may complain of sore throat Frequently, the discovery of a mass in the neck on routine examination leads to the diagnosis Peritonsillar ab-

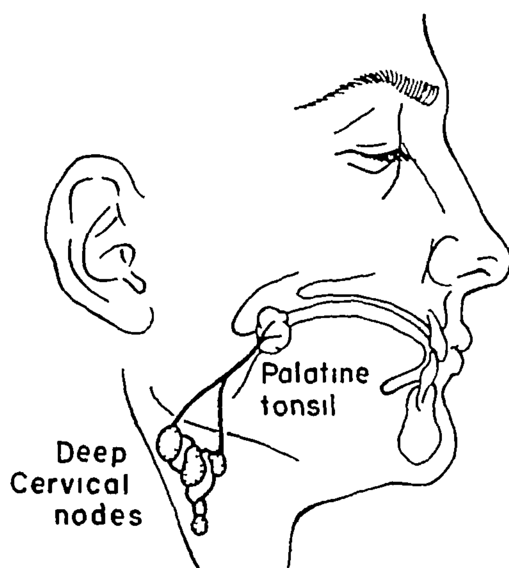


FIG. 60 —Lymphatic drainage of the palatine tonsil, path of spread of cancer to regional lymph nodes

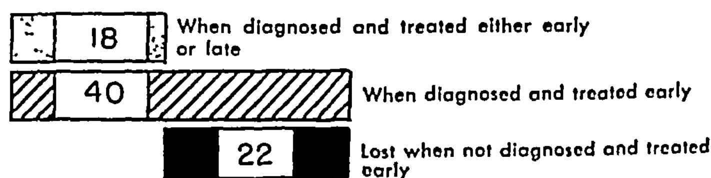


FIG 61 —Percentage of five year cures of cancer of the tonsil (See also Fig 31, p 90)

scess, tuberculosis and syphilitic gumma should be considered in the differential diagnosis.

Treatment and prognosis —Irradiation is the best treatment for cancer of the tonsil Surgery requires an unusually radical operation which carries a high mortality The prognosis for tumors of the tonsillar region is relatively favorable, some reports indicating that as high as 40 per cent of the patients treated showed no evidence of cancer five years later The best prognosis is obtained only by early diagnosis and proper treatment (Fig 61).

CASE HISTORY

C T White man, aged 53

Chief complaint None. The patient visited his dentist for treatment.

Onset and course On consultation for treatment, the dentist discovered a mass in the right tonsillar area The following history was obtained. The patient has worn complete upper and lower dentures for five years. Recently he has had difficulty in swallowing This he attributes to his inability to chew food well with his dentures. The patient has no complaints except for recent slight pain in the right ear

Regional examination Oral examination reveals a firm and fixed mass 2 × 2 × 1.5 cm. originating in the region of the anterior portion of the right palatine tonsil. It also includes the anterior pillar which is moderately fixed, and a portion of the soft palate. The uvula is displaced to the left and the oropharyngeal opening is markedly narrowed There are no other significant findings The dentures fit quite satisfactorily and occlusion and function are good.

Examination of the neck reveals a hard, fixed mass 2 × 1 × 1 cm. in the right anterior cervical region.

Tentative diagnosis Tumor of the tonsil

The patient was referred immediately to a specialist, whose laboratory reports follow

Laboratory reports Biopsy—squamous cell carcinoma Serology—Kahn and Wassermann reactions negative Roentgenogram—chest plate probable invasion of mediastinum.

Final diagnosis Squamous cell carcinoma of right palatine tonsil with metastases to the neck and mediastinum.

SLIGHT PAIN ON SWALLOWING MAY BE THE FIRST SYMPTOM OF CANCER OF THE TONSIL

XXII

Carcinoma of the Salivary Glands

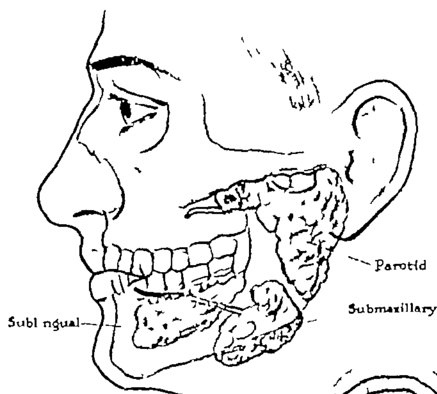
Anatomic and Physiologic Considerations

Salivary glands may be classified according to· (1) size (major, minor), (2) location (parotid, submandibular, sublingual), and (3) type of secretion (mucous, serous, mixed)

There are three major paired salivary glands the parotid, the secretion of which empties into the vestibule via the parotid duct, and the submandibular and the sublingual, whose secretions empty into the oral cavity proper via their respective ducts (Fig 62) The smaller ones are the labial, buccal, palatal and lingual glands None is found in the gingiva or the anterior portion of the hard palate

Parotid salivary gland —The parotid, the largest of the three salivary glands, is situated primarily in the retromandibular fossa It reaches medially to the styloid process and the muscles arising from it and upward to the external acoustic meatus Surrounding the acoustic meatus on its inferior surface, the gland reaches posteriorly to the mastoid process and the sternocleidomastoid muscle A superficial part of the gland extends anteriorly on the outer surface of the mandibular ramus and masseter muscle as a thin, triangular layer The outer surface of the gland is situated quite superficially, covered only by its capsule the superficial fascia, and the skin The upper border of the superficial part of the gland covers, in front of the ear, the temporomandibular articulation The inferior corner of the gland extends below the plane of the lower border of the mandible in the space between the mandibular angle and the sternocleidomastoid muscle

Parotid duct —The parotid duct courses forward over the masseter muscle to the anterior border Here it turns sharply medially around the buccal fat pad and passes obliquely through the buccinator muscle and the mucosa to enter the vestibule of the oral cavity opposite







MINOR SALIVARY GLANDS

FIG. 62.–The major and minor salivary glands. (Modified from Massler M. and Schour I *Atlas of the Mouth* [Chicago: American Dental Association, 1948])

the upper second molar A small papilla marks the outlet of the duct This orifice is the narrowest part of the duct and just permits the entrance of a narrow probe The position of the duct may be determined externally by the middle third of a line drawn from the external auditory meatus to midway between the lower border of the ala of the nose and the vermilion of the upper lip The parotid duct is about 2½ in long and ⅛ in in diameter It is subject to injury in facial wounds and operations

Parotid saliva —The partoid is a pure serous or albuminous gland The terminal or secretory portions of the glandular cavities contain only serous cells Parotid saliva, on account of its watery character, is well adapted to the functions of cleansing the mouth and teeth, moistening and softening dry food and dissolving many substances so that they may stimulate the taste buds of the tongue Through its ptyalin content, under favorable conditions, starch is converted for the most part into maltose It is unlikely that this action occurs to any appreciable degree in the food bolus before it is swallowed

Submandibular salivary gland —This gland is located in the submandibular triangle inferior to the mylohyoid muscle The fascial covering is not as adherent as in the parotid salivary gland The facial vein courses superficial to the gland, the facial artery through it and the hypoglossal and lingual nerves and the lingual artery deep to it

Submandibular saliva —The submandibular gland of man is a mixed but mainly serous gland Most of the terminal portions of the gland contain only serous cells, the others are mucous, often with serous cells at the blind ends The secretion is usually described as a clear, rather thin and somewhat viscid liquid which tends to froth easily. It contains mucin, salts and ptyalin Foods in general stimulate a secretion rich in mucin whereas irritants produce a profuse flow of watery saliva Calculi occur most frequently in the submandibular glands and their ducts

Sublingual salivary gland —This gland is a long, flattened body situated close to the medial surface of the mandible which in this area shows a slight depression, the sublingual fossa On its superior surface the gland is covered by the thin mucous membrane and causes an elevation on the floor of the oral cavity, the salivary eminence The sublingual gland is, in fact, a glandular complex since there is not one common duct for all its lobules The sublingual glands are mixed glands with many more mucous than serous cells

Submandibular and sublingual ts —From the upper part of the

inner surface of the submandibular gland the duct (Wharton's) extends anteriorly and medially It turns to the upper and medial or oral surface of the mylohyoid muscle and then courses along the inner surface of the sublingual gland after crossing the lingual nerves superiorly Each submandibular duct opens into the mouth through a soft eminence or papilla, the salivary caruncle alongside the frenum of the tongue (Fig 44, p 127)

The duct of the major sublingual gland usually enters the mouth through the same orifice. This duct occasionally opens on the mucous membrane near the orifice of the submandibular duct. The lesser sublingual ducts are 8–20 in number and open separately on the surface of the mucous membrane along the ridge formed by the sublingual gland.

Effects of alteration of saliva.—The saliva has several functions, namely those of digestion, lubrication, cleansing and bacteriostasis. When the salivary secretions are reduced or altered, dental caries are frequently noted. This is particularly true in patients who have received irradiation in the oral cavity for a cancerous process Xerostomia or dry mouth results when there is cessation of salivary secretion. Ptyalism or excessive salivation is seen after radical surgery of the oral cavity in certain drug toxicity reactions, parkinsonism and in pregnancy

Clinical Considerations

Major salivary gland tumors.—No discussion of oral and facial cancer would be complete without inclusion of the salivary glands (2, 55) Of the three paired salivary glands—the sublingual, submandibular and parotid—the last is by far the most frequently involved. The two most common tumors of the parotid gland are the mixed tumor and the adenocarcinoma. The former may become malignant· the latter is malignant. Warthin's tumor (papillary cystadenoma lymphomatosum) is uncommon, and the diagnosis is usually made only after microscopic study of the tissue.

MIXED TUMOR.—The mixed tumor of the parotid gland may be first noted during early adult life and is likely to be located just below or anterior to the ear (Fig 27 D p 77 and Fig 63) The patient usually seeks advice only after the tumor has been present for 5–15 years and has gradually increased in size to the point of causing embarrassment. The tumor is firm, usually mobile and encapsulated. There is no stand

ard histologic pattern, and the exact origin of these tumors is disputed They were originally called mixed tumors because it was believed that both the ectodermal and the mesodermal germ layers contributed to their formation They may persist after inadequate surgical treatment and are usually resistant to radiation therapy There is disagreement

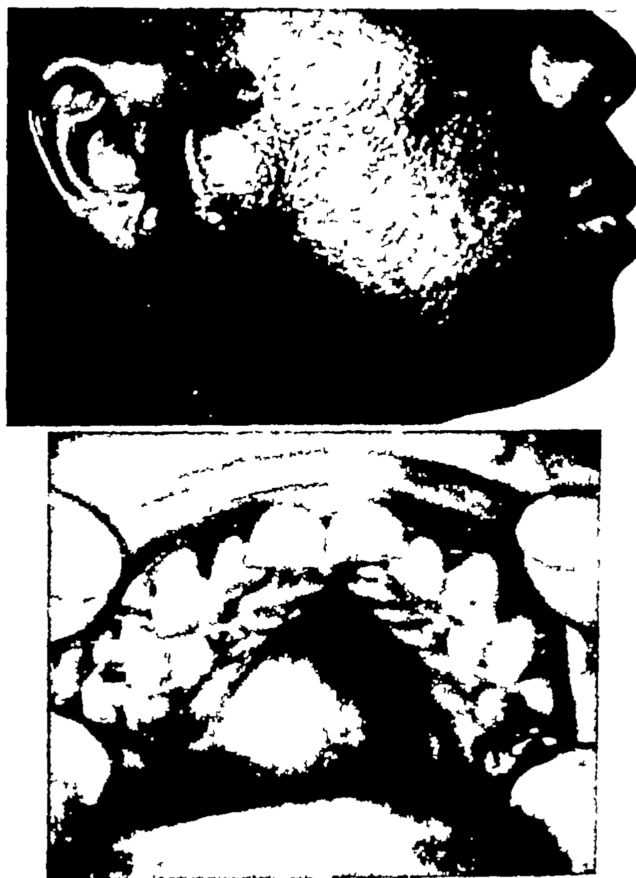


FIG 63 (above) —Mixed tumor of the parotid gland, mistaken for abscess The incision made for intended drainage was poorly planned

FIG 64 (below) —Mixed tumor of the palate This tumor usually is in the mid line and is seldom ulcerated

as to how benign or malignant they are Nevertheless, a certain number show all the characteristics of malignant tumors and metastasize

The "mixed tumor" may also be found occasionally in the other major salivary glands, the palate (Fig 64), lip, cheek and tongue

ADENOCARCINOMA —In contrast to the mixed tumor, the adenocarcinoma of the parotid gland arises later in life and grows more rapidly

It is quite hard, is not encapsulated and may ulcerate and cause pain (Fig 27 F) The tumor is fixed to the underlying tissue and skin so that it is not mobile. The facial nerve may become involved by infiltra tion of the tumor causing paresis or paralysis of the muscles supplied by the facial nerve. Radical surgery and radiation therapy are utilized.

Tumors originating locally from other than the salivary glands may be found in this region (Table 6 p 98) It is also important to differentiate metastases in this area which may come from sites below the clavicles such as the breast.

Minor salivary gland tumors—Salivary gland tumors are often for gotten in the differential diagnosis of intraoral swellings Minor glands of the oral mucosa which are present almost everywhere in the oral cavity may be the sites of neoplasms. The consideration of these tu mors in the oral mucosal lesions is important because of their clinical behavior Whereas a surgeon may treat a fibroma or a cyst rather casu ally or conservatively the tumors of the salivary glands because of their tendency to recur require a more careful removal. The most common site of origin of the minor salivary glands in the oral cavity is the palate The most common neoplasm is the mucoepidermoid tumor This is in contrast to the tumors of the major salivary glands the ma jority of which are mixed tumors (pleomorphic adenomas) of the parotid gland (48)

CASE HISTORY

B G White man, aged 62.

Chief complaint Swelling below right ear for six weeks.

Onset and course Patient was in good health until about six weeks previously At that time, while shaving, he noticed a small hard lump below the right ear The mass continued to grow and after about two weeks became painful. During the past two weeks it has grown rapidly A "sore" has devel oped on the outside. There is difficulty in opening the mouth and in swallow ing.

Physical and regional examination A fairly well developed and nourished man who appears somewhat dehydrated and older than his stated age. He complains of pain in the right jaw and ear and difficulty in swallowing. In the region of the right angle of the mandible is a stony hard, fixed mass $10 \times 10 \times 5$ cm which extends up to the ear and down into the neck. On the surface in about the central portion is an ulcerated exuberant growth. The right lateral pharyngeal wall is tender but no mass can be palpated intra orally No other masses are palpable in the submandibular sublingual or cervical regions.

Tentative diagnosis Adenocarcinoma of the right parotid salivary gland

Laboratory reports Biopsy—adenosarcoma of parotid salivary gland Serology—Wassermann and Kahn reactions negative Roentgenogram—no change noted in right mandible

Final diagnosis Adenocarcinoma of the right parotid salivary gland

CANCER OF THE PAROTID SALIVARY GLAND MAY BE A CAUSE OF FACIAL PARALYSIS

XXIII

Secondary Spread of Oral and Facial Carcinoma

Direct or Local Growth

Cancer begins as a *localized* disease Local spread occurs by infiltration into healthy tissue and by invasion of preformed spaces in or surrounding the tumor (lymphatic sinuses and vessels, perineural and perivascular lymphatic channels and the interfascial spaces) Cancer can be treated best while it is still localized (Fig 28 p 84) Consequently early diagnosis is of paramount importance.

Distant Spread

Cancer is a disease which must be considered in terms not only of local growth but also of distant spread and growth, following its entrance into lymphatic and blood vessels (Figs 65 and 66 and Fig 8 p 31) The rapidity of growth and the type of spread vary with the type of tumor and its location.

In cancer of the oral cavity the spread is both local and frequently to the regional lymph nodes (Fig 32, *E* and *F* p 99 and Fig 39 p 119) The latter is less true of carcinoma of the skin of the face Oral cancer rarely disseminates below the clavicle Spread to the regional lymph nodes does not always occur nor is it always evident at the time of examination The absence of clinical evidence of metastasis is not conclusive Cancerous lymph nodes are enlarged and primarily stony hard, but tend to break down later On the other hand the lymph nodes may become enlarged also because of lymphatic drainage from chronic inflammation of the primary site of the cancer They are then soft and may be painful

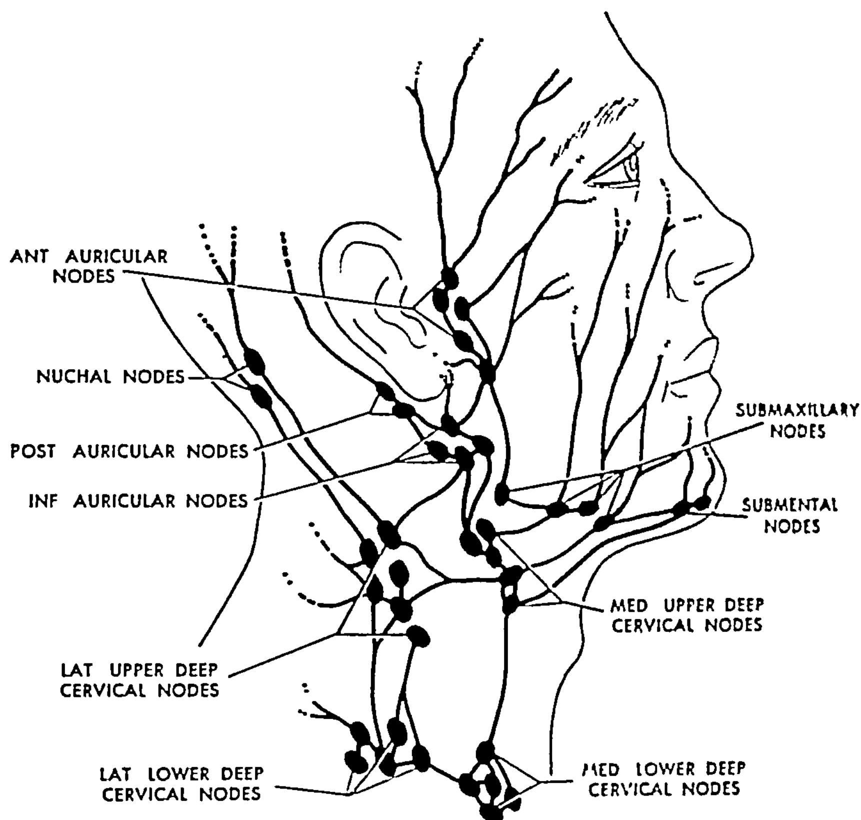


FIG 65 —Regional lymph nodes and lymph vessels of the superficial structures of the head and neck (Adapted from Sicher, H *Oral Anatomy* [St Louis C V Mosby Company, 1952])

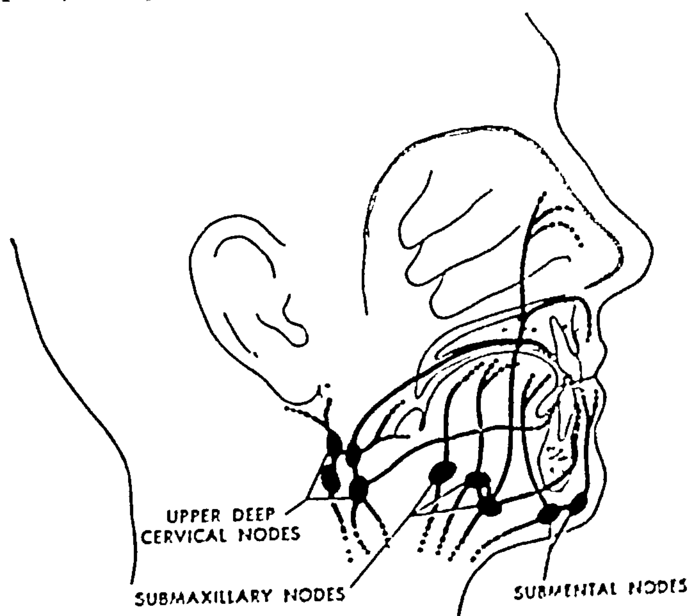


FIG 66 —Regional lymph nodes and lymph vessels of the deep structure of the mouth and face (Adapted from Sicher, H *Oral Anatomy* [St Louis C V Mosby Company 1952])

The evaluation and diagnosis of the disease in any patient is not complete until one has searched for the possible spread of the growth. Proper treatment and prognosis can be rendered only after this search has been thorough and a correct diagnosis made. The prognosis for a patient with a metastatic focus is generally poor and varies with the particular type of growth.

Sometimes the first sign of facial, oral or pharyngeal cancer is the metastatic mass in the neck (Fig 52, p 135 and Fig 67) (81) If the





FIG. 67 —*Left* swelling of the neck. Sole complaints were of embarrassment and inconvenience. *Right* squamous cell carcinoma of the ear Complete oral and facial examination of patient in *A* revealed a sharply demarcated, ulcerated lesion on the back of the ear which proved to be squamous cell carcinoma which had metastasized to the neck.

primary lesion is not found, frequent and careful examinations should be repeated, with particular attention being paid to the epiglottis, base of the tongue, palatine tonsil and oral and nasopharynx. Too often the asymptomatic swelling of the neck is believed to be due to spread of infection from the teeth and tonsils when actually it is a result of spread of cancer

DIAGNOSIS OF A PRIMARY ORAL CANCER REQUIRES THOROUGH EXAMINATION FOR EVIDENCE OF SPREAD

XXIV

Oral Manifestations of Leukemia

Clinical Considerations

Leukemia is a type of cancer of the blood-forming or hemopoietic tissues (see Chap XXIX) It is characterized by uncontrolled growth of white blood cells This results in a marked increase in the number of immature leukocytes in the circulating blood stream as well as in the tissues Leukemia is classified according to the particular type of white blood cell involved The disease may be either acute or chronic (86)

Acute leukemia is often encountered in children It presents many similarities to the disease found in adults but also some important differences In children, as in the case of other malignant neoplasms, leukemias tend to have a more rapid course than in adults Leukemia in children is nearly always extremely acute and rapidly fatal. It cannot be treated by irradiation in a way comparable to the treatment of chronic leukemia in the adult The diagnosis is usually made late in the short course of the disease

In acute leukemia the systemic symptoms and the oral lesions are so similar for the different cell types that one description will suffice The systemic symptoms resemble those of an acute infection The onset is often sudden, with fever, profound exhaustion, pain in the joints, headache, sore throat, dental pain, petechiae, epistaxis and severe secondary infection Death may be due to pneumonia, circulatory collapse, infection or hemorrhage. Although the spleen is usually enlarged, it cannot always be palpated The lymph nodes, particularly the cervical ones, may be enlarged

The dentist is frequently consulted first regarding enlarged and bleeding gingiva (Fig 68) and ulcerated lesions in the mouth Because of the high incidence of the oral lesions in leukemia, this disease is

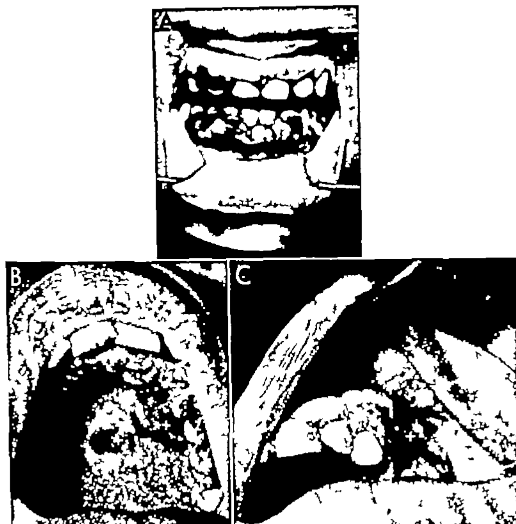


Fig 68 —*A*, gingiva of child with acute myelogenous leukemia. Note general enlargement of gingiva, which bled readily on the slightest trauma. *B* and *C* intra oral photographs of adult patient, P R., with manifestations of lymphosarcomatosis. Note the irregularity of the mucosal and gingival surfaces + areas from which biopsy specimens were taken. (From Sarnat, B G and Weinmann, J P A.M.A. Arch. Otolaryng. 61 654-657 1955)

important to the dentist. The lesions are due to the extravascular accumulation of immature white blood cells, edema, infection and necrosis of the tissues (Fig 69) The gingiva may become so enlarged that it covers most of the crowns of the teeth Gentle rubbing of the gingiva with a cotton applicator will produce abnormal bleeding (Fig 68) Some patients may present the initial complaint of a toothache in a noncarious tooth Diagnosis consists of a complete examination of

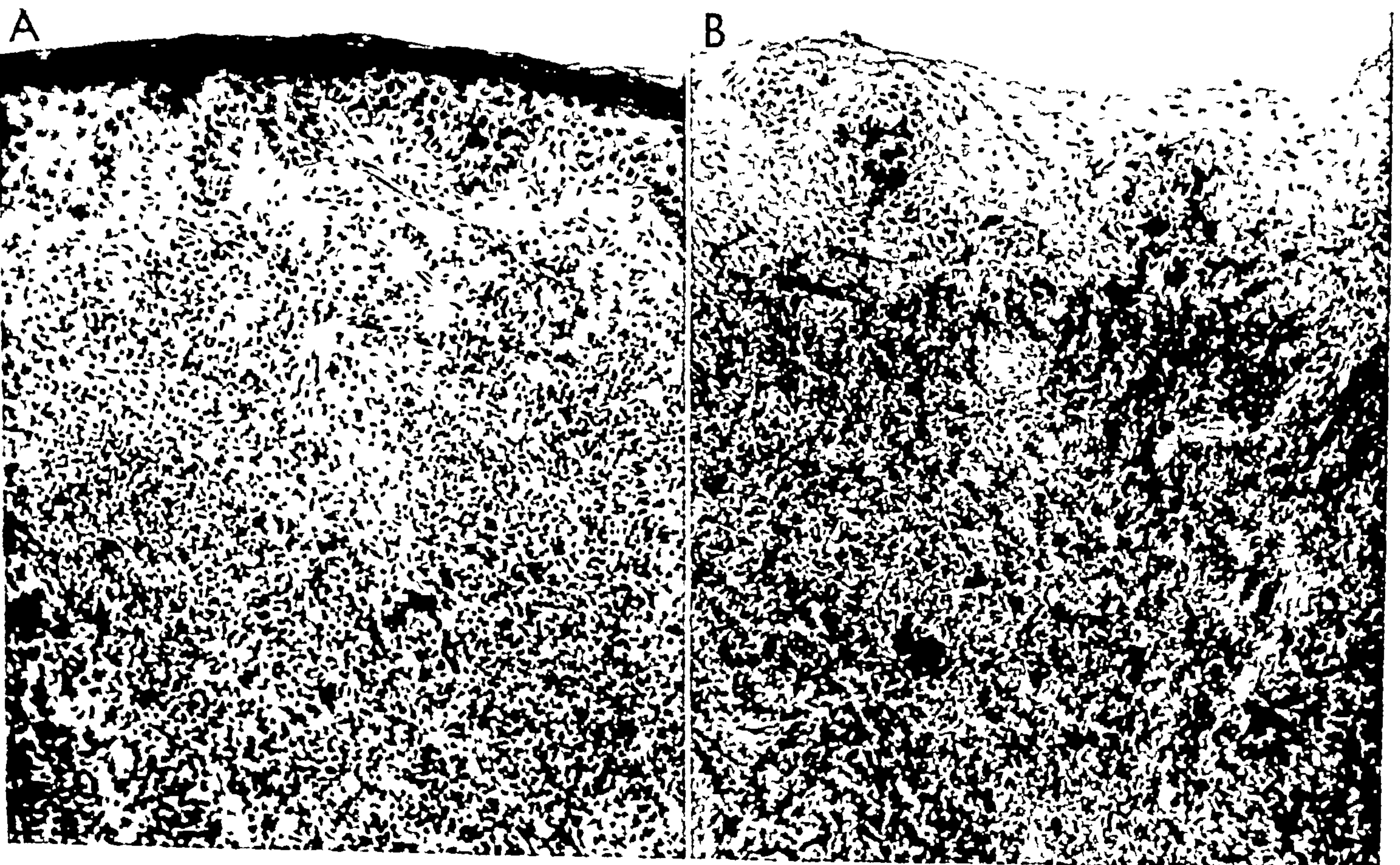


FIG 69.—Photomicrographs of chronic gingivitis (*A*) and lymphosarcoma of the gingiva (*B*). Note the uniformity in the staining of the nuclei of the infiltrating cells in *A* and the polychromasia in *B*. (*B* is from patient in Fig 68, *B* and *C*.) Reduced ⅓ from magnification × 120. (From Sarnat, B. G., and Weinmann, J. P.: A.M.A. Arch. Otolaryng. 61:651-657, 1955.)

the circulating blood and biopsy of the bone marrow (sternal puncture)

The treatment of the oral lesions in leukemia should be only palliative and directed toward maintaining the best possible oral hygiene relieving pain and refraining from aggravating the local necrotic process Surgery of any kind is usually contraindicated It may result in massive necrosis severe hemorrhage and rapid death or the clinically asymptomatic leukemia patient may suddenly exhibit an acute and rapidly fatal form of the disease

The use of irritant and caustic drugs is contraindicated Oral hygiene can be maintained by the use of either hydrogen peroxide or normal saline mouth washes and irrigations Antibiotics or a thick aqueous paste of zinc peroxide helps control the secondary infection in the necrotic lesions as well as the accompanying extremely foul odor Use of a tooth brush is contraindicated. Cotton swabs are preferred.

The diet should be liquid or semisolid. Anesthetic troches can be administered before eating in cases of severe pain Dental extractions should be postponed during the acute stage of the disease. If the leukocyte count drops to nearly normal limits either following therapy or during a remission of the disease, dental extractions may be performed. Some have advocated the removal of teeth without bleeding by placing small rubber bands over the neck of a single-rooted tooth. As the rubber bands are slowly moved toward the apex of the tooth by daily manipulation, necrosis of the periodontal membrane will follow If any surgical procedure is to be carried out, antibiotics should be administered and possibly a number of blood transfusions should be given, beginning in the preoperative period.

CASE HISTORY

H Z. Negress, aged 10

Chief complaint Severe pain in the upper right lateral incisor for eight hours.

Onset and course Patient has had no complaints and was in good health until about eight hours before when the upper right lateral incisor became acutely painful for no apparent reason Pain was not relieved by aspirin The patient has also felt quite warm.

Physical examination Pulse 112 per minute respiration 22 per minute, temperature 101 8 F (rectal) Patient is a fairly well developed and nourished child who appears acutely ill and is holding her hand over the right side of the face.

The lips are pale and dry The tongue has a heavy brown coating. Examination of the upper right lateral incisor shows no evidence of either

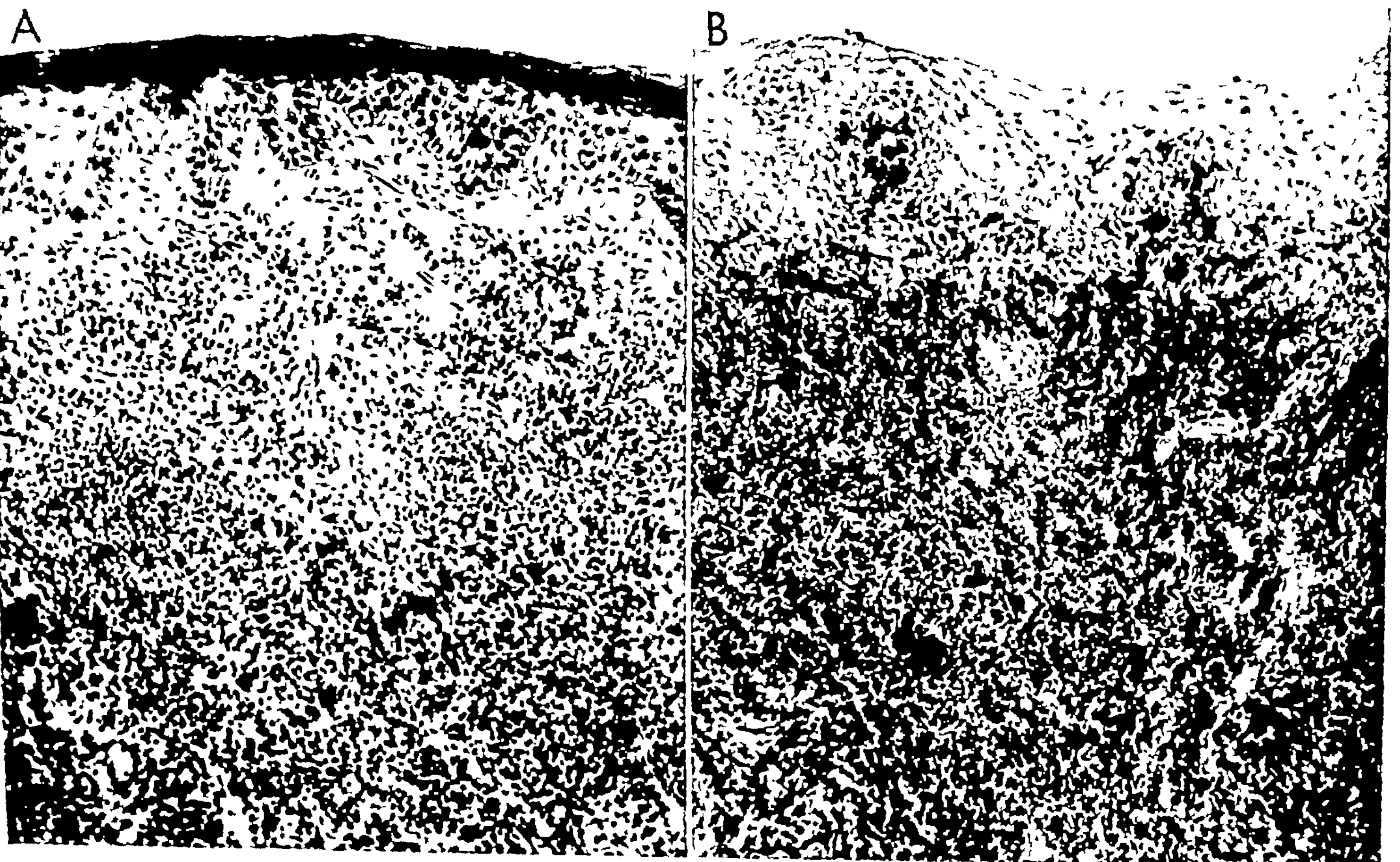


FIG 69.—Photomicrographs of chronic gingivitis (*A*) and lymphosarcoma of the gingiva (*B*). Note the uniformity in the staining of the nuclei of the infiltrating cells in *A* and the polychromasia in *B*. (*B* is from patient in Fig 68, *B* and *C*.) Reduced ⅓ from magnification × 120. (From Sarnat, B. G., and Weinmann, J. P.: A.M.A. Arch. Otolaryng. 61:651-657, 1955.)

XXV

ecancerous Oral Lesions

CLINICAL CONSIDERATIONS

cancerous" must be used with certain qualifications It
that cancer of the mouth is sometimes associated with
g 70 *A* and *B* and Fig 50 p 133) papillomas chronic
D) fissures (Fig 70 *E*) and warts (Fig 70 *F*) The
sa of the oral cavity and pharynx associated with Plum
ndrome (vitamin B deficiency) also predisposes these
er especially in women (41 44, 80) In the cancer sus
nt these lesions after adequate irritation, may undergo
inge Not all such lesions, however will become cancer
the term precancerous may be condemning a nonguilty
npossible to determine which of the precancerous lesions
benign and which will become malignant. Therefore it is
e to remove at once for microscopic examination those ap-
iign lesions which are subjected to chronic irritation or
signs of change

kia —No discussion of cancer of the oral cavity would be
ithout a consideration of leukoplakia (72) It may occur
milion zone of the lip (Fig 24, p 73) or the mucous
where in the buccal cavity and is also seen in the pha
rachea and vagina. It is however found most fre
igue (Fig 70 *A*) and inside the cheeks The hard
a, especially in edentulous areas (Fig 70 *B*) are
Leukoplakia may either be a single small spot or
as the entire dorsal surface of the tongue. Its
gular The consistency and color of the surface
bluish white (Grade I) to a thick, leathery
white (Grade IV) In this latter type, chronic

caries or any other external pathologic process The gingiva is markedly swollen and spongy, dark red and bleeds readily when touched gently with a cotton applicator No ulcerations are noted in the mouth The breath is unpleasant The cervical lymph nodes are enlarged In the upper left quadrant of the abdomen a mass can be palpated (spleen) No petechiae are noted in either the mucous membrane or skin

Examination of the eyegrounds reveals marked engorgement of the retinal veins, hyperemia of the optic disk (nerve head) with indistinct edges (papilledema), scattered hemorrhages of various sizes and a few white exudates throughout the retina

Tentative diagnosis *Acute leukemia*

Laboratory reports Urine—positive for albumin Blood—red blood cells, 2,540,000 per cu mm , hemoglobin, 51 per cent, white blood cells, 115,000 per cu mm , with differential count of 86 per cent myeloblasts (immature cells), 2 per cent neutrophils, 8 per cent lymphocytes and 4 per cent monocytes Serology—Wassermann reaction positive (this may occur in leukemias)

Final diagnosis Acute myelogenous leukemia

The patient was transferred to the medical service where symptomatic treatment was instituted Five blood transfusions (1,200 cc) were given She died 18 days after the onset of symptoms

SYSTEMIC DISEASES ARE SOMETIMES MANIFEST EARLY IN THE ORAL CAVITY

XXV

Precancerous Oral Lesions

Clinical Considerations

The term "precancerous" must be used with certain qualifications It is well known that cancer of the mouth is sometimes associated with leukoplakia (Fig 70 A and B and Fig 50 p 133) papillomas chronic ulcers (Fig 70 D) fissures (Fig 70 E) and warts (Fig 70 F) The atrophic mucosa of the oral cavity and pharynx associated with Plummer Vinson syndrome (vitamin B deficiency) also predisposes these tissues to cancer especially in women (41 44, 80) In the cancer susceptible patient these lesions after adequate irritation may undergo malignant change. Not all such lesions however will become cancer so that to use the term precancerous may be condemning a nonguilty lesion. It is impossible to determine which of the precancerous lesions will remain benign and which will become malignant. Therefore it is good practice to remove at once for microscopic examination those apparently benign lesions which are subjected to chronic irritation or which show signs of change.

Leukoplakia —No discussion of cancer of the oral cavity would be complete without a consideration of leukoplakia (72) It may occur on the vermilion zone of the lip (Fig 24, p 73) or the mucous membrane anywhere in the buccal cavity and is also seen in the pharynx esophagus trachea and vagina. It is, however found most frequently on the tongue (Fig 70 A) and inside the cheeks The hard palate and the gingiva, especially in edentulous areas (Fig 70 B) are also common sites Leukoplakia may either be a single small spot or cover large areas such as the entire dorsal surface of the tongue. Its borders are usually irregular The consistency and color of the surface may vary from a thin bluish white (Grade I) to a thick, leathery ridged and warty yellow white (Grade IV) In this latter type, chronic

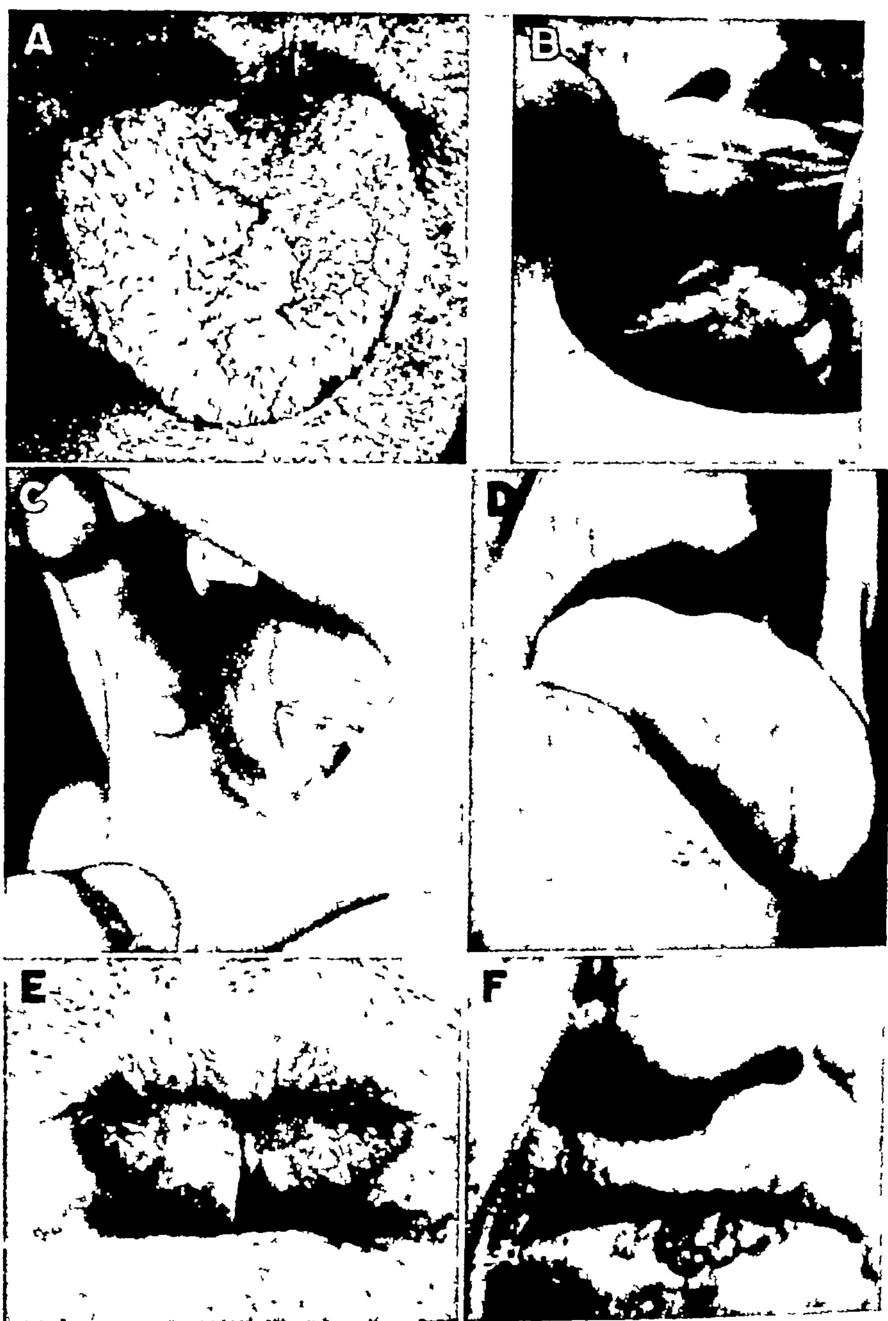


Fig 70.—Precancerous lesions of the mouth which may become cancerous. However, all questionable lesions should be removed, others should be examined carefully and regularly. *A*, leukoplakia of the tongue, note prominent white thickening. *B*, leukoplakia of mucogingival fold constantly irritated by upper denture. *C*, fibroma of cheek frequently traumatized by teeth. It may become ulcerated and infected and may bleed. *D*, painful traumatic ulcer of tongue present at least three months. Ulcer base was soft, not indurated. A rough carious tooth caused the lesion, which healed several days after extraction. Because of chronicity, cancer must be considered until disproved. *E*, chronic fissure in midline of lower lip present over 25 years. It opened during cold weather and became infected and painful. *F*, verrucous lesion of lower lip which grows slowly and is often irritated. Some consider it a low grade cancer.

fissures or ulcers are sometimes seen. Histologic sections show an epi thelial overgrowth or hyperkeratosis with chronic inflammatory cells in the subepithelial layer Not all white lesions are leukoplakia (Plate II facing p 197 center left) Hyperkeratosis lichen planus, moniliasis, the mucous patch and areas exposed to chemical and physical agents may also have the appearance of white patches

Most cases of leukoplakia probably do not develop into cancer However cancer is not uncommonly found in its vicinity Any patient with leukoplakia should be checked for the four "S's" (1) smoke, (2) spirits (3) spices, (4) syphilis. Patients with leukoplakia should be warned of the possible danger of malignancy They should discon tinue the use of all oral irritants such as tobacco alcoholic beverages highly seasoned and hot foods and should report for periodic check ups The diet should be supplemented with vitamins if necessary If the patient has syphilis specific treatment should be instituted, especially since luetic glossitis leukoplakia and carcinoma of the tongue are frequently found associated with each other If the lesion is small enough, it can be completely excised and examined microscopically for possible malignant change Larger suspected lesions can be biopsied before treatment is instituted Excision with direct closure appli cation of a skin graft, and electrocautery destruction are accepted methods of treatment.

CASE HISTORY

L. K. White man, aged 56

Chief complaint White coating of tongue of two years duration.

Onset and course Patient has been a heavy smoker for 40 years, smoking his pipe almost continuously In addition, he has been a heavy drinker and has consumed about 1 pt. of whiskey a day His diet has not always been adequate, and vitamin B complex was prescribed at one time by a physician. About two years previously a thin white coating appeared on the top of the tongue. This has gradually spread over most of the surface of the tongue and become thicker and irregular It has caused him no inconvenience Use of the tooth brush on this area does not help remove the coating.

Regional examination Most of the anterior two thirds of the dorsum of the tongue has a thick, leathery white covering with several shallow crevices. It is not tender to palpation No ulcerations are evident Laterally and anteriorly the papillae of the tongue are atrophic. Many teeth are missing and those which are present need dental treatment. Oral hygiene is poor The rest of the oral cavity reveals nothing significant. No masses are palpable in the submandibular sublingual or cervical regions

Tentative diagnosis (1) Leukoplakia of tongue (2) Syphilis (?)

Laboratory reports Biopsies—leukoplakia no cancer seen on examination

of three different specimens Serology—Kahn and Wassermann reactions positive

Final diagnosis (1) Leukoplakia of the dorsum of the tongue (2) Syphilis

It was recommended that the patient discontinue at once the use of tobacco, alcohol and other irritants Vitamin B complex was prescribed, oral health was improved and treatment was given for syphilis

Addendum The patient's tongue was examined carefully every month and biopsy done of areas suspected of being cancerous Eighteen months after the initial examination, a biopsy revealed the presence of carcinoma of the tongue

ALTHOUGH NOT ALL PRECANCEROUS LESIONS DEVELOP INTO CANCER, THEY SHOULD BE OBSERVED REGULARLY AND CAREFULLY BOTH CLINICALLY AND MICROSCOPICALLY WHEN NECESSARY

Cancer of the Jaws (Mandible and Maxilla)

XXVI

Anatomic and Physiologic Considerations of the Jaws

Bone tissue may be defined as a supporting tissue whose cementing substance is calcified and whose regularly disposed collagenous fibrils are arranged in layers The cells (osteocytes) lies in cavities (lacunae) in and between the layers The cells receive their nourishment through anastomosing processes lying in very minute channels (canaliculi) The surface of bone may be lined by osteoblasts (bone-forming cells) and osteoclasts (bone-destroying cells) The functions of bone tissue and bones are (1) support, protection and attachment, (2) hemopoiesis, and (3) emergency mineral reserve

Compact Bone

Compact bone is composed of haversian systems in which 4–20 layers or lamellae are arranged around a canal. These haversian canals contain blood and lymph vessels which nourish the cells in the lacunae nerves and connective tissue. Between the haversian systems are unresorbed portions of older layers of bone called interstitial lamellae. Compact or haversian system bone constitutes the greater part of the shafts of the long bone and the plates of the flat ones

Cancellous Bone

In this type of bone the lamellae are arranged in relatively thin and freely interconnecting plates or bars which surround irregular bone

marrow spaces of varied size These spaces connect freely with one another The structure of the plates and bars often becomes complex by resorption and rebuilding The plates are not permanent and unchanging but are continually being rebuilt in new directions in response to the mechanical conditions to which the bone as a supporting organ is subjected The bone marrow may be either yellow or red The latter is a hemopoietic connective tissue richly supplied with blood vessels, nerves and lymphatics

The Periosteum

The periosteum is the formative and protective membrane which covers the outer surface of the bone It consists of two layers The outer layer is rich in blood vessels and nerves and has a dense arrangement of collagenous and elastic fibers. The inner or osteogenic layer has a loose arrangement and may contain numerous osteoblasts It is rich in cells and has fewer blood vessels than the outer layer

The periosteum forms the immediate covering of all the bones and is continuous over their entire surface except for the portion covered by cartilage or tendinous and ligamentous attachments As long as growth of bone occurs at a periosteal surface, a layer of osteoblasts can be seen along the underlying bony surface Bones that are united by a suture are covered by a common periosteum. If the overlying tissues are carefully removed from a long bone, the periosteum will be seen as a smooth, white, lustrous membrane having much the same appearance as a tendon on most of its surface

The Maxilla

The maxilla consists of a central body, which is hollowed out by the maxillary sinus, and four processes The frontal process ascends from the anteromedial corner of the body and connects with the frontal bone The zygomatic process forms the lateral corner of the body and connects with the zygomatic bone The horizontal palatine process arises from the lower edge of the medial surface of the body and forms with the corresponding process of the other maxilla the major part of the skeleton of the hard palate The curved alveolar process, the fourth, extends down from the lower lateral margin of the body and carries the maxillary teeth

The body of the maxilla is a four-sided pyramid with the base facing

the nasal cavity and an almost horizontal axis the apex is elongated into the zygomatic process The four sides of the pyramid are (1) a superior (orbital) surface which forms the greater part of the orbital floor· (2) an anterolateral (malar) surface which forms part of the skeleton of the cheek and face (3) a posterolateral (infratemporal) surface which turns toward the infratemporal fossa, and (4) an inferior surface which, in its greater part, is covered by the alveolar process but is visible from within the maxillary sinus as its floor

The Mandible

The mandible has a strong horseshoe-shaped body that continues posteriorly on either side upward into the mandibular ramus The body carries the alveolar process. The ramus ends in two processes the anterior muscle-covered coronoid process and the posterior articular condyloid process The posterior border of the ramus and the inferior border of the body meet at the mandibular angle

The Alveolar Process

The alveolar process may be defined as that portion of the maxillae and mandible which supports the teeth (Fig 13 p 53) It is a projection of the jaw bone which forms and surrounds the sockets in which the roots of the teeth are held by their periodontal membranes. This type of joint is known as a gomphosis The alveolar process consists of (1) an outer and an inner cortical plate· (2) a thin perforated lamina forming the socket in the strict sense the alveolar bone proper also called the lamina dura or cribriform plate, and (3) an intervening layer of supporting spongiosa. The alveolar process develops with the teeth. Its structure is molded in response to the presence and functional demands of the teeth and disappears when they are lost. The supporting bone is influenced greatly by the function of the tooth

Histologic structure –The structural elements are not different from those of the bone elsewhere in the jaws. There is no clearcut boundary line between the bone of the alveolar process and the bone of the maxillae and mandible on which it rests The periosteum which covers the cortical plate of the alveolar process is continuous with that covering the cortical plates of the jaws

Growth –The growth of the alveolar process is accomplished by (1) apposition of bone at the free borders of the alveolar process of

the maxillae and mandible (vertical growth), (2) formation of alveolar bone around the growing roots of the teeth, and (3) reorganization of the spongiosa Thus by a co-ordination of apposition and resorption growth of the alveolar process occurs vertically, laterally and anteriorly

Functional Analysis of the Facial Skeleton

The facial skeleton, like all bones, is built on a highly efficient architectural pattern It is designed to resist the great masticatory pressures exerted on the teeth with a minimum of material At the same time it

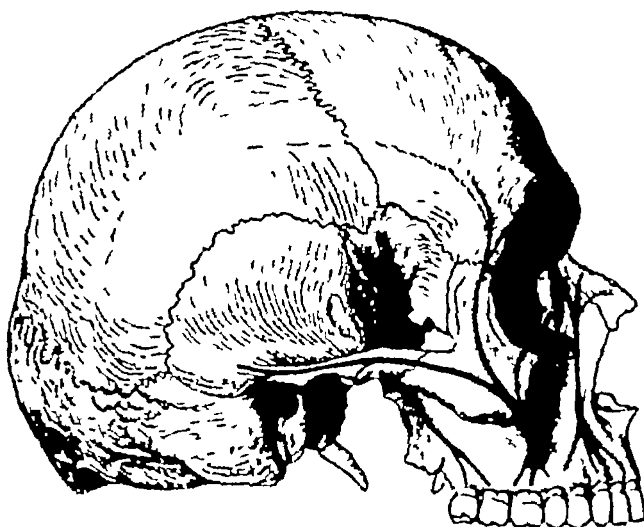


Fig 71 —*Pillars of the skeleton of the upper part of the face* (From Weinmann, J P, and Sicher, H *Bone and Bones* [St Louis C V Mosby Company, 1955])

provides adequate support to the walls of the nasal cavities and the orbits It has been reported that the average normal masticatory force of an individual is 175 lb /sq in in the molar region This is gradually distributed along lines of stress (trajectories) that extend in many directions to various areas of the skull capable of absorbing the force (Figs 71 and 72) The force of mastication exerted on a given tooth is transmitted through the periodontal fibers as tension to the lamina dura of the alveolar bone The oblique course of the fibers of the periodontal membrane permits the transfer of the pressure of occlusion to a pull on the alveolar bone and cementum

From here the forces are transmitted along the trabeculae of the supporting bone of the alveolar process toward the base of the sockets

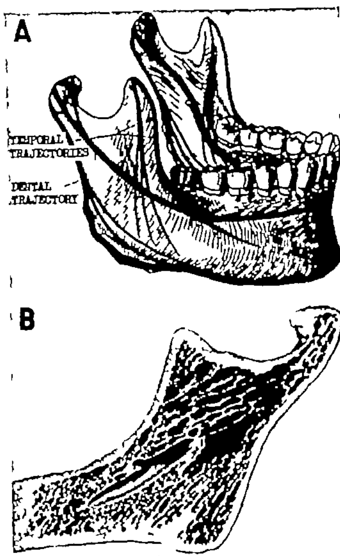


FIG. 72.—Lines of stress of the lower jaw *A*, trajectories of the mandible. *B* section through right mandibular ramus. Note parallel plates of spongy bone ascending toward the mandibular condyle. (From Weinmann, J P., and Sicher H.: *Bone and Bones* [St. Louis C. V Mosby Company 1955])

In the maxilla, three major trajectories arise in the basal part of the alveolar process and end on the bone of the skull (Fig. 71). In the mandible the trabeculae unite as a trajectory which runs backward below the sockets and then diagonally up and back through the ramus to the condyle Thus the masticatory pressure is finally transmitted to the base of the skull via the temporomandibular articulation (Fig 72)

Reaction of Bone to Growth of Tumors

The bone tissue, despite its hard calcified nature, is highly adaptive to different degrees of tension and pressure. The basic and dual re-

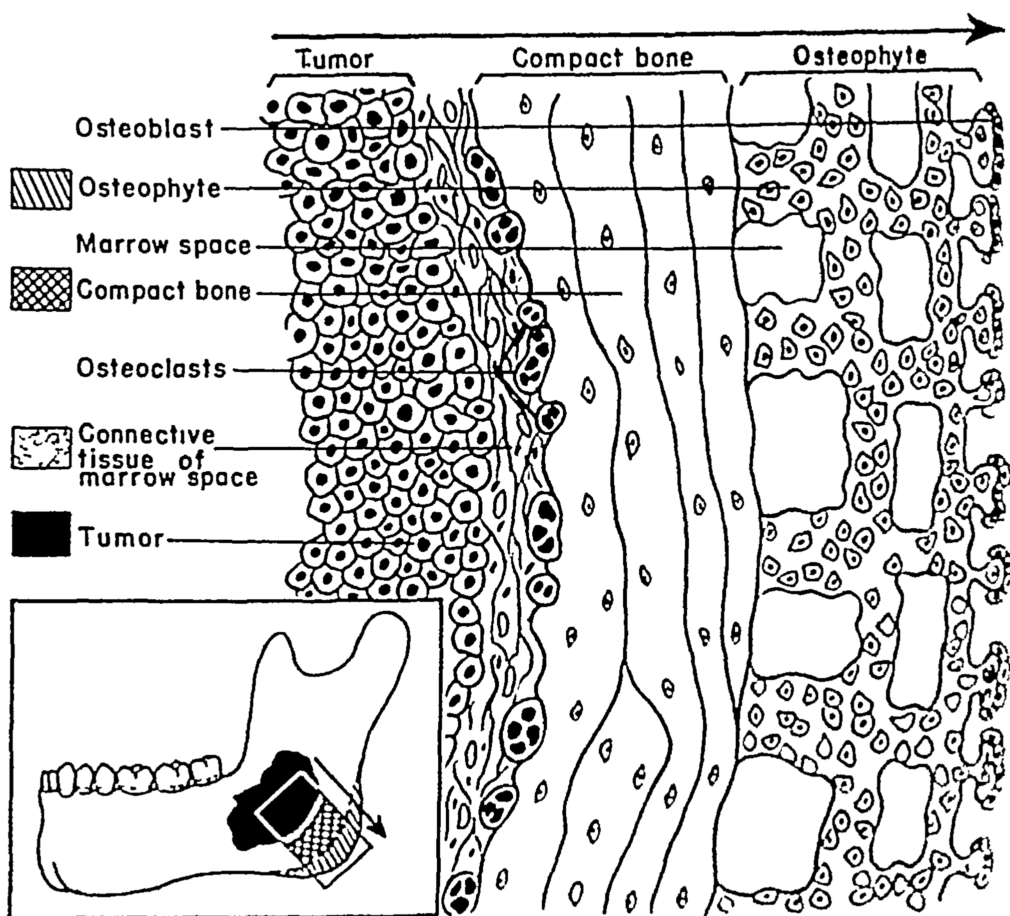


Fig 73 —Diagram of gross and histologic effects of a growing tumor on a bone

sponse of resorption and apposition is evident in the reaction of bone to the presence of growing tumors (Fig 73) Despite the spread of a tumor, the bone does not always become perforated tending instead

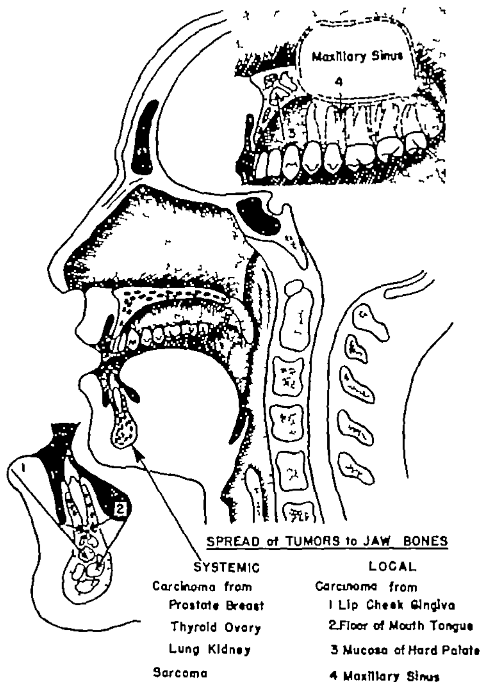


FIG. 74 —Diagram of local and metastatic spread of cancer to the jaws.

TABLE 7.—CHARACTERISTICS OF JAW TUMORS WHICH APPEAR MULTILOCULAR ON ROENTGENOGRAMS*

HISTOPATHOLOGIC DIAGNOSIS	AGE WHEN SEEN, YR	CLINICAL HISTORY	CLINICAL FINDINGS	LOCATION IN MANDIBLE	EDENTULOUS AREA	MISCELLANEOUS
Benign tumors						
Ameloblastoma (see Fig 88, *A*)	71	Several years ago left side of mandible enlarged, discharge from molar area 6 mo ago, reoperated on 14 mo later	Hard, nonmovable mass extending from 1 cm below zygoma to lower border of ramus	Angle & ramus	Entire mandible	Pathologic fracture subsequently
Ameloblastoma (see Fig 88, *B*)	17	"Gum boil" behind last tooth of mandible 6 wk	0 5 cm mass retromolar area, moderate expansion of mandible	Angle & most of ramus	None	
Ameloblastoma-odontoma (see Fig 88, *C*)	40	1 cm lump back part of mandible noted 6 wk ago while shaving	Firm, fixed, nontender 5 cm mass extending from mental foramen to angle	Molar area	Involved area	
Multiple follicular cyst	45	Pain in jaw 8 mo , lower teeth extracted 7 mo ago, swelling of jaw & discharge 2 wk	Moderate enlargement of mandible from angle to cuspid area, draining sinus left molar area	Molar area, angle & ramus	Entire mandible	Bilateral involvement of mandible
Giant cell tumor (local)	13	Painless progressive swelling both sides of mandible for 6 yr	Both rami of mandible enlarged & irregular	Everything posterior to bicuspid area except condyle	Involved area	Blood Ca & P normal, bilateral involvement of mandible
Giant cell tumor (hyperparathyroidism)	10	Painful jaw 13 yr , all teeth extracted 4 yr ago, mandible began to swell 4 wk ago	Smooth, sharply outlined tumor extending halfway up ant border of ramus, 1 cm mass in maxilla near ala of nose, 3 × 1 cm mass, region of thyroid	Angle	Entire mandible	Serum *preop* Ca 14 6 mg %, P 2 4 mg %, *postop* Ca 9 2 mg %, P 5 1 mg %

*Modified after Byars, L. T , and Sarnat B G Surg , Gynec & Obst 83 355 1946

TABLE 7—*Continued*

Histopathologic Diagnosis	Age When Seen Yr.	Clinical History	Clinical Findings	Location in Mandible	Edentulous Area	Miscellaneous
Fibroma	15	Swelling of jaw 4 mo. sharp shooting pains to ear & some disability in jaw; dentist blamed erupting 3d molar	Firm, fixed, nontender mass in parotid region extending to angle of jaw	Angle & ramus	None	
Malignant tumors						
Fibrosarcoma (see Fig. 81)	4	Intermittent toothache 8 wk. rapid swelling of face & mandible, 6 wk dentist & otolaryngologist found nothing sulfanilamide prescribed	Large, hard mass extending from lower border of mandible to upper border of ear	Molar area and every thing posterior	Involved area	
Osteogenic sarcoma (see Fig. 75)	20	Swelling of mandible 5 mo impacted wisdom tooth diagnosed & extracted wound did not heal	Diffuse, firm swelling at angle of jaw surrounding tissues indurated unable to open mouth	Molar area, angle & ramus	None	
Metastatic ca. from breast (see Fig. 79)	57	Numbness tingling of lower lip & lump in mandible 6 mo, molars in area extracted & 8 deep x ray treatments with no relief diagnosis of ca. of breast 1½ yr ago	Nontender round, hard mass, 1.5 cm diam., in molar region	Molar area	Involved area	
Metastatic ca. from thyroid (see Fig. 80)	55	Dull pain in mandible 5 wk.	Resilient mass lingual premolar region of mandible stony-hard diffuse enlargement of right lobe of thyroid	Bicuspid area	Entire mandible	Tumor also metastasized to right iliac crest

to maintain itself with only gradual changes in shape The bone tissue is resorbed in the path of the tumor pressure as a result of the differentiation of osteoclasts in the intervening connective tissue At the same time, however, the loss and weakening of bone are compensated by the formation of new bone along the periosteal surface away from the tumor Figure 73 illustrates the architectural reconstruction of the jaw bone during the growth of a tumor

The basic response of bone deviates only slightly depending on the speed of growth of the tumor If the growth is slow, the compensatory formation of bone consists in the apposition of new lamellae If growth is rapid, the new bone consists of rapidly forming trabeculae (osteophytes) which are arranged at right angles to the surfaces (Fig 73) and which build an emergency framework (39) The latter may be filled in and replaced by compact bone at a later stage. If the destruction of bone proceeds at a greater rate than the compensatory formation of new bone, a pathologic fracture may result

Primary and Secondary Cancer of the Jaws

Malignant tumors which arise primarily in the mandible or maxilla are usually nonepithelial in origin and consequently are sarcomas The two exceptions are the carcinoma of the maxillary sinus and the ameloblastoma if it becomes truly malignant. Malignant tumors of the jaws are similar to those in the rest of the skeletal system It is interesting to note that there are no malignant tumors of the jaw of dental origin with the possible exception of the ameloblastoma which, however, seldom becomes truly malignant Occasionally a sarcoma arises in a distant part of the body and spreads (metastasizes) to the jaws

Malignant tumors which arise from epithelium (carcinoma) may spread to the jaws either from a neighboring area or from a distant site (Fig 74) Local spread of carcinoma to bone is common from the lip, cheek, gingiva, floor of the mouth, tongue, palate and maxillary sinus Less frequent are metastases of carcinoma to the jaws from the breast, ovary, prostate, thyroid, kidney, rectum and lung

Primary and secondary malignant tumors of the jaws sometimes appear multilocular on roentgenograms These must be differentiated from other lesions which also are multilocular The final diagnosis should be based on a microscopic study of the tissue (Table 7).

BONE IS A HIGHLY REACTIVE TISSUE AND RESPONDS TO VARIOUS INSULTS

XXVII

Primary Cancer of the Jaws Sarcoma

Clinical Considerations

SARCOMA IS a particular type of cancer which arises from nonepithelial structures, especially connective tissue. It may arise primarily from bone, bone marrow blood vessels or connective tissue proper Sarcomas usually originate in the jaws and occur in the younger age group (first to third decades) Carcinoma (tumor of epithelial origin) tends to occur in the older age group (third decade and later)

The early diagnosis of tumors of the jaws is not always easy Pain is one of the first symptoms though not necessarily an early one It may be intermittent, with the periods of freedom from pain becoming shorter The pain may be dull or sharp and radiate to the teeth, ear side of the face or temple Fever may be present. No mass may be palpable in the early stages. Sometimes swelling and irregularity of the gingiva are the first signs (Plate I, frontispiece center right) In a few weeks to months, however a large swelling may develop deforming half the face The tumor may have either a smooth or irregular surface and may become tender to palpation With the increase in size and involvement of the muscles, opening the mouth may become difficult. With bone destruction the teeth become loose. Roentgenograms are an important aid in determining the site and amount of destruction (Fig 75 and Fig 81 p 193) The typical x ray picture of osteogenic sarcoma shows a "sun ray" effect as a result of osteophytic bone formation. The diagnosis should be confirmed by histologic study of tissue The clinical course varies with the type of tumor Most jaw tumors are not sensitive to radiation. Since difficulty is sometimes encountered in differentiating clinically the sarcomas from benign tumors, osteomyelitis, syphilis and tuberculosis (Fig 76) microscopic examination of the tissue is imperative



FIG 75 —Primary sarcoma of the jaws A, lateral roentgenogram of mandible Note irregular radiolucent area below molar roots B, photomicrograph of specimen from same patient showing fibrous tissue growing without plan Histopathologic diagnosis was osteogenic sarcoma from membranous bone, ×89 (From Byars, L T, and Sarnat, B G Surg, Gynec & Obst 83 355, 1946)

Tumors may occur not only in the alveolar process, body and ramus of the mandible but occasionally in the condyle Here the most striking and characteristic symptom is asymmetry of the lower part of the face and a shifting of the mandibular midline toward the unaffected side Occlusion is thus also altered and the jaw may be unilaterally prognathic A fibrosarcoma of the capsule of the temporomandibular joint may severely impair articulation



FIG. 76.—Tuberculosis of mandible. Lateral roentgenogram of child with chronic progressive enlargement of the lower half of the face showing considerable destruction of the mandible. There was no pain or drainage. Mandibular teeth in the region were loose Tentative clinical diagnosis was sarcoma of the jaw but biopsy revealed multinucleated giant cells with changes suggesting tuberculosis Further medical studies confirmed the diagnosis.

CASE HISTORY

E. W White woman, aged 26

Chief complaint Tender upper bicuspid and swelling of surrounding gingiva for two weeks

Onset and course The patient had been perfectly well until about two weeks previously when she noted tenderness of the upper left first bicuspid when chewing. On looking in the mirror she saw for the first time that the gingiva was enlarged and irregular It was not painful (Plate I, frontispiece, center right) She at once consulted her dentist who immediately removed a portion of the abnormal gingiva and bone and sent it to the pathology laboratory for microscopic analysis. Because of the biopsy report, she was referred to a surgeon for final diagnosis and treatment.

Regional examination Particularly on the labial and lingual surfaces of the upper left first bicuspid, the gingiva is dark red, raised, irregular and soft. The tooth is more movable than normal and is tender to percussion. Otherwise the intraoral examination reveals nothing significant. No abnormal masses are palpable in the submandibular submental or cervical areas.

Tentative diagnosis Carcinoma of the gingiva with spread to bone.

Laboratory reports Biopsy—osteosarcoma Serology—Wassermann and Kahn reactions negative. Roentgenogram—no evidence of destruction seen on dental roentgenograms of the cuspid bicuspid molar area or roentgenograms of the maxilla.

Final diagnosis Osteosarcoma of the maxilla

IN FACIAL PAIN OF UNKNOWN CAUSE
THINK OF CANCER OF THE JAWS

XXVIII

Secondary Cancer of the Jaws: Carcinoma and Sarcoma

Local Spread of Carcinoma to the Jaws

Clinical considerations.—Carcinoma arising from epithelium in the maxillary sinus, lip, buccal mucosa, gingiva, floor of the mouth, tongue and the nasal or oral mucous membrane of the hard palate spreads readily and invades the bones (Fig 74, p 175) Carcinoma follows the point of least resistance and sometimes grows along natural channels This is well exemplified by invasion of the mental foramen and retrograde growth along the mandibular canal and also by the invasion of extraction wounds Carcinoma never occurs primarily in the bone After carcinoma has invaded a bone, it is more difficult to eradicate, and consequently the prognosis is considerably poorer

In an older person, any persistent or recurrent pain in the side of the face radiating to the ear and temple calls for diligent and, if necessary, repeated search for cancer This should include the maxillary antrum, the tonsillar pillars, the nasopharynx and the pyriform sinus

Maxillary sinus.—Cancer of the maxillary sinus can be diagnosed earliest by means of roentgenograms These are frequently taken routinely, especially when the patient complains of vague pain, paresthesia or anesthesia of the face. Usually the growth remains undiscovered until it has broken through its bony shell Otherwise there can seldom be reason to suspect the presence of cancer until increasing growth causes swelling of the mucogingival fold, the palate or the cheek (Fig 77, A) Some other possible effects may be trismus, exophthalmos, nasal obstruction, secondary infection causing pain and possibly drainage or loose (Fig 78, *A*) and painful teeth After the injudicious extraction of a bicuspid or molar that has become loose or painful, the growth

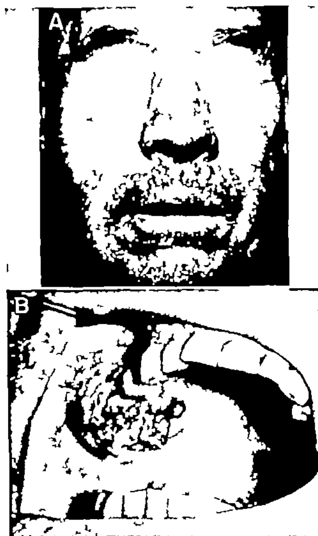


FIG. 77.—Carcinoma of maxillary sinus which spread into the oral cavity *A*, swelling of face on side of the carcinoma and mucopurulent drainage from the nose. *B* intraoral view of same patient showing large fungating mass in upper molar area. Because the molars were loose "pyorrhea" was diagnosed and the teeth removed, facilitating spread of the carcinoma through the alveoli into the mouth. On subsequent biopsy of the intraoral lesion, a mistaken diagnosis of cancer of the gingiva was made.

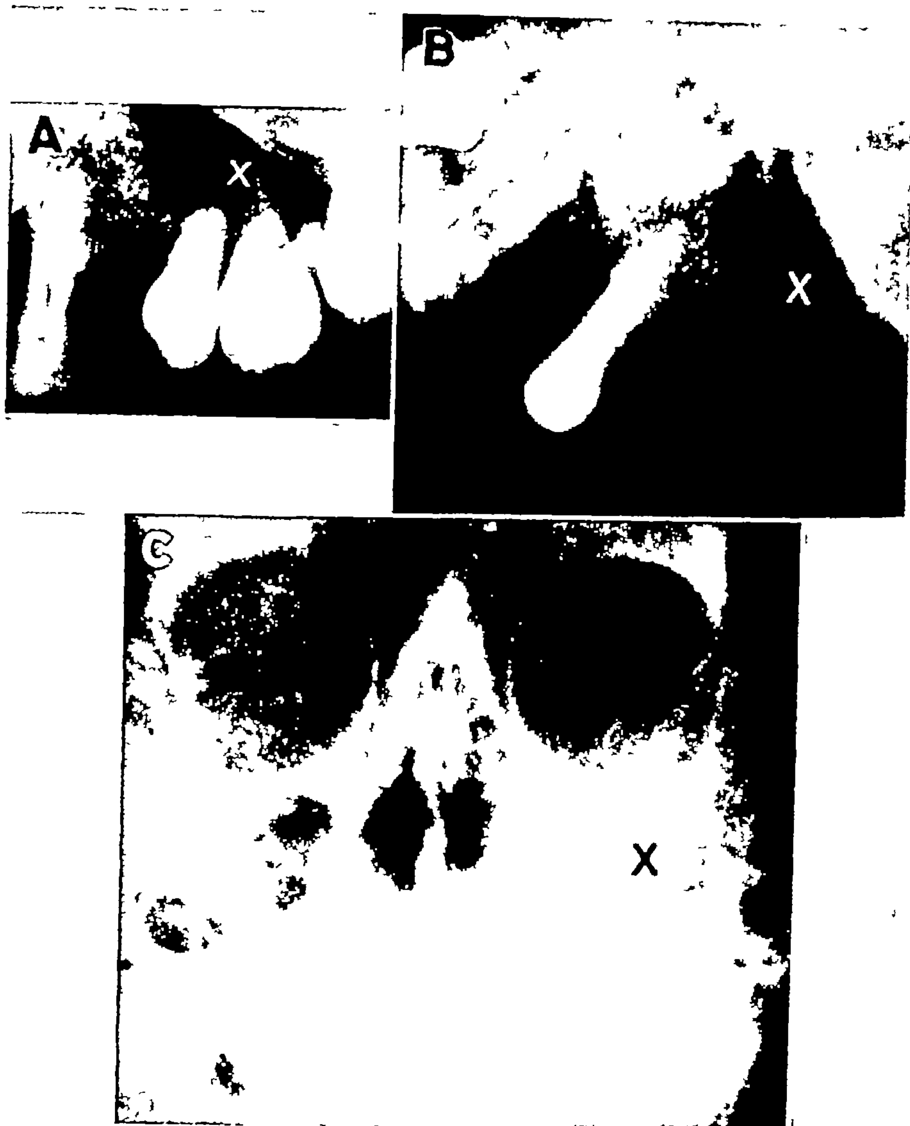


Fig 78—Carcinoma which spread beyond the maxillary sinus *A*, small dental film with limited view of the area Note radiolucent area around roots in bicuspid-molar region Teeth were extracted because loose What was believed to be a granuloma was curetted No biopsy was taken *B*, film with larger view of area showing regional teeth now absent and extent of radiolucent area incompletely visible in *A* The "granuloma" proliferated and biopsy revealed squamous cell carcinoma The patient was then referred to a specialist *C*, posteroanterior roentgenogram of the face Note boundaries of the right maxillary sinus and its radiolucency On the left, boundaries are indistinct, there is a large radiopaque area, and destruction of both maxilla and zygoma is evident

may progress through the extraction wound (Figs 77 *B* and 78 *B*) When the first sign noted is the growth in the mouth, cancer of the gingiva is sometimes erroneously diagnosed (Plate I frontispiece, bottom right) Obviously the prognosis is best when the tumor is still contained in the maxillary sinus After the growth has broken through the bony walls and invaded the surrounding tissues the prognosis is poorer

CASE HISTORY

A. Z. White woman, aged 62

Chief complaint Loose, painful teeth, upper molar area, for one month.

Onset and course Patient went to her dentist because of "pyorrhea" The dentist took roentgenograms and told her she had a cyst in the upper jaw (Fig 78 *A*) The upper left second bicuspid and first and second molars, which were quite loose, were readily extracted (Fig 78 *B*) However the dentist found some firm grayish red tissue instead of a cyst. The tissue was removed but not sent in for microscopic examination. After about two weeks, because the extraction site failed to heal, the dentist made a smear of the area on a glass slide. The laboratory reported "Vincent s infection." He then applied gentian violet and silver nitrate on alternate visits Two weeks of this treatment had no effect and a mass was now protruding at the extraction site After consultation with the physician, it was decided to remove a piece of tissue for microscopic study The patient was referred to a maxillofacial surgeon.

Physical examination A fairly well developed and well nourished woman. The left cheek is swollen. The upper left buccal area is edentulous and bulging and contains a gray-red fungating, friable mass which bleeds readily on manipulation. It encroaches on the hard palate The patient speaks with a nasal intonation. There is a firm, fixed, nontender mass 2.5 × 2 × 2 cm in the left submandibular area and another about 2 × 1 × 1 cm. in the left supraclavicular area

Tentative diagnosis Squamous cell carcinoma of the gingiva.

Another biopsy was taken, a blood sample drawn and roentgenograms of the maxillary sinuses ordered.

Laboratory reports Biopsy—squamous cell carcinoma. Serology—Wassermann and Kahn reactions negative. Roentgenogram—the right maxillary sinus shows the usual radiolucency The left is completely clouded and there is evidence of bone destruction of the sinus floor and outer walls and a portion of the zygoma. This is consistent with carcinoma of the maxillary sinus which has invaded bone (Fig. 78 *C*)

Final diagnosis Squamous cell carcinoma of left maxillary sinus with invasion of the maxilla and the zygoma, with metastasis to the neck.

"PYORRHEA CAUSES LOOSE TEETH—SO DOES CANCER OF THE JAWS

Metastatic Cancer to the Jaws: Carcinoma and Sarcoma

Clinical considerations—Although most carcinomas of the jaws originate from adjacent epithelial structures, occasionally neoplasms metastasize to the jaws from a distant source. Just as cancer of the mouth may spread to the neck and elsewhere, so may certain cancers arising in distant parts of the body metastasize to the jaws (Fig. 74, p. 175) (43, 52). The following types of carcinoma have a predilection for metastasis to bone, including the jaws: carcinoma of the prostate, ovary, breast (Fig. 79), thyroid (Fig. 80), lung, rectum and kidney (hypernephroma). If the primary source of a carcinoma of the jaw is not known, these sites should be examined as a possible focus. These carcinomas may also spread to the pelvis and spine in addition to the jaws. Consequently roentgenograms of all these areas should be taken.

Carcinoma does not usually cause as much bone deformity as sarcoma. Locally spreading carcinoma begins as a peripheral tumor of the jaw and eventually invades the body of the jaw. Metastatic carcinoma, however, is usually a central tumor of the jaw. Because of its central location, pressure is exerted on the mandibular nerve and one of the earliest symptoms may be pain (Fig. 23, p. 72). Later, as the tumor increases in size, pain is more prominent and continuous and may be associated with paresthesia and/or anesthesia. In addition, the tumor growth leads to resorption of the bone and loosening and separation of the teeth. In some of these cases a mistaken diagnosis of "pyorrhea" is made and the teeth are extracted by the unsuspecting dentist. With increased bone destruction by the tumor a pathologic fracture of the mandible may occur (Fig. 23). This is sometimes the first sign. In the case of a metastatic tumor of the prostate, osteosclerosis of the jaw may be observed in the roentgenogram.

Although metastasis of carcinoma to the jaw from a distant site is not common, metastasis of sarcoma to the jaw is even less common. An occasional sarcoma from a distant site, such as the femur, has been reported to have metastasized to the mandible.

Case History

L. Y. White woman, aged 55.

Chief complaint (seven years previously). Tingling and numbness of lower left lip for four months. Continuous dull pain in the bicuspid area of the left side of the mandible for one month.

Onset and course. When first seen seven years previously with the above mentioned complaints, her dentist took roentgenograms of the jaw and found

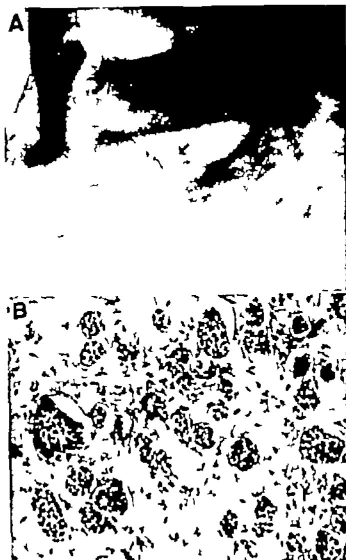


FIG. 79 —Carcinoma of mandible metastasized from the breast. A, lateral roentgenogram of the mandible showing radiolucent zone in molar region. B photomicrograph of biopsy specimen of same patient. Note islands of malignant undifferentiated epithelial cells, × 98 (From Byars, L. T and Sarnat, B G Surg., Gynec. & Obst. 83 355 1946.)

destruction of bone The patient stated that she had a goiter for 25 years, but it remained unchanged.

Regional examination (seven years previously) On the lingual surface of the left lower jaw in the premolar area is a mass extending to the lower border of the jaw It can also be palpated externally It is quite painful to palpation There is a stony hard, diffuse enlargement of the right lobe of the thyroid.

Tentative diagnosis Fibroma of mandible

An opening was made into the jaw bone and a rather vascular type of tumor was removed

Laboratory report Biopsy—metastatic carcinoma from the thyroid

Subsequent history Later the thyroid was removed and the microscopic



FIG 80—Carcinoma of mandible metastasized from the thyroid Thyroid carcinoma was not suspected until after microscopic study of the jaw tissues *A*, lateral roentgenogram of the mandible showing multiple radiolucent zones in bicuspid-molar region *B*, photomicrograph of biopsy specimen of same patient The thyroid glandular tissue is hyperplastic, cells as a whole are well differentiated, no abnormal mitotic figures are observed, × 89 (From Byars, L T, and Sarnat, B G Surg, Gynec & Obst 83 355, 1946)

report was adenocarcinoma Four years after diagnosis of metastasis of carcinoma of the thyroid to the mandible, the patient complained of pain in the right iliac crest and difficulty in walking Two series of x-ray therapy, each of 2,400 r, were given to this area When again seen three years after x-ray therapy, she had had pain for five months During the past few months a lump appeared in the left mandible Until recently she had had no trouble in the jaw since the original operation seven years before The mass was removed by electrocautery and found to be metastatic thyroid tumor tissue

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tumors —The distribution of tumors in
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ı of Dargeon (13) and Helmhloz (66)
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ed for about 8 per cent of the tumors in

PATIENTS AND DISTRIBUTION OF TUMORS
RRING IN CHILDHOOD*

\O OF ILDREN	SITE	NO. OF CHILDREN
	Helmholz	
37	Intraoral and neighboring organs	56
79	Bones	121
41	Soft somatic tissue	18
33	Lymphoid tissue	141
17	Genitourinary tract	56
6	Central nervous system	327
	Skin (epithelioma)	16

d.) Cancer in Childhood and a Discussion of Certain
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XXIX

Cancer in Childhood

Clinical Considerations

Cancer in childhood is erroneously regarded as a rare disease. In truth it is one of the most frequent causes of death before the age of 15. There is no doubt that cancer of the oral cavity and face does occur in children and young adults (13, 52, 57, 60, 66). This is often overlooked because of the impression that cancer is a disease of middle life and old age only. Cancer knows no age limit. Malignant tumors may be present at birth or even during fetal life. Despite the closer medical supervision that infants and children are receiving today, the diagnosis of cancer is still frequently missed or made too late.

A leading cause of death.—That cancer is becoming a leading cause of death in children can be attributed not so much to an actual increase in the total number of cases of cancer but rather to better control and lesser death rate of other childhood diseases, especially the contagious diseases. The increasing recognition and more accurate diagnosis of childhood cancer have likewise raised the statistical incidence (Fig. 1).

Types of tumor.—The type of cancer which occurs during childhood is quite different from that which occurs later in life. It is probably diagnosed later. Furthermore, the course is generally rapid and metastases take place early. The mortality rate is high.

The sarcoma (nonepithelial) is the common tumor of the first 15 years of life (90–97 per cent). Embryonal (teratoma, embryoma of the kidney) and neurogenic tumors (neuroblastoma and retinal glioma) are usually encountered before the age of 3. Tumors of the central nervous system, leukemia (Chap. XXIV), lymphoma and Hodgkin's disease, nasopharyngeal fibroma and endothelial myeloma of the bone (Ewing's tumor) are most common from age 4 to 12 years. Among children, sarcoma causes nine times as many deaths as carcinoma

Among all age groups however carcinoma causes 21 times as many deaths as sarcoma.

Anatomic distribution of tumors—The distribution of tumors in childhood varies somewhat with different reports Some indication can be obtained from the data of Dargeon (13) and Helmhloz (66) (Table 8) pertaining to the number of patients and distribution of tumors.

It is interesting to note that in Dargeon s series the head and neck accounted for 17 per cent and in Helmholz s series the intraoral and neighboring organs accounted for about 8 per cent of the tumors in

TABLE 8—NUMBER OF PATIENTS AND DISTRIBUTION OF TUMORS OCCURRING IN CHILDHOOD*

SITE	NO. OF CHILDREN	SITE	NO. OF CHILDREN
Dargeon		*Helmholz*	
Head and neck	37	Intraoral and neighboring organs	56
Bones	79	Bones	121
Soft somatic tissue	41	Soft somatic tissue	18
Lymphoid tissue	33	Lymphoid tissue	141
Genitourinary tract	17	Genitourinary tract	56
Gynecologic system	6	Central nervous system	327
		Skin (epithelioma)	16

Adapted from Dargeon, H W (ed.) Cancer in Childhood and Discussion of Certain Benign Tumors (St. Louis C V Mosby Company 1940)

childhood. This was exclusive of tumors of bone Sarcoma of the tongue has been reported at birth, salivary gland tumors at 6 weeks carcinoma of the upper lip at 20 months and fibrosarcoma of the mandible at 4 years

Diagnosis of cancer—The early symptoms of childhood cancer are often vague and obscure and frequently are similar to those seen in the more common childhood diseases General irritability anemia, anorexia, loss of weight and vomiting occur relatively late in the disease. Pain is not an early prominent symptom except in cancer of the bones Usually symptoms of pressure or derangement of function in the immediate vicinity of the diseased tissue are the only signs suggestive of early cancer in children. However to diagnose cancer early one must suspect its possibility in any child with

(1) Abnormal persistent swelling
(2) Persistently enlarged lymph nodes not due to infection
(3) Intermittent fever
(4) Some anorexia and weight loss
(5) Nasal obstruction other than that caused by adenoids
(6) Vague, persistent, slowly increasing bone pain
(7) Enlarged bleeding gingiva
(8) Toothache and/or earache
(9) A single enlarged tonsil

Because one cannot depend on obtaining an adequate history from a child, we must depend largely on a thorough examination

Diagnosis of tumors of bone. Osteogenic sarcoma —There may be pain, impaired function, fever and swelling of the affected part in osteogenic sarcoma, but not all of these symptoms are present in every case (60) The roentgenogram taken early may show no changes Later it may show the "sun ray" picture of beams radiating from a central mass In some instances it is difficult to interpret the roentgenogram The growth may sometimes be confused either with other osseous neoplasms or with osteomyelitis (Fig 76, p. 181)

In general the diagnosis of tumors of the bone must be made by exclusion There are no pathognomonic signs early in the disease, and even in a moderately advanced stage differential diagnosis may offer difficulties As is well known, the disease is insidious in the growing child The active growth of the child may mask the early subjective and objective findings of the disease which would be more readily recognizable in the adult who has attained maximal development

Up to the age of at least 6 years the child makes relatively few complaints Trauma, infections and other disorders are apparently accepted by the young child as part of his existence and are soon forgotten Therefore the diagnosis of disease in the preschool period, and frequently even later, must usually be made from objective evidence It is obvious that the symptoms should be thoroughly investigated when a child complains of either pain or disability, especially if it is localized and lasts more than a few days

There are two clinical observations which may be helpful in the diagnosis of childhood neoplasm, including that of cancer of a bone

1 The unusual child The child whose appearance, growth or physical capacity varies from that recognized as the average or normal state may have a neoplasm (Fig 27, C, p 77).

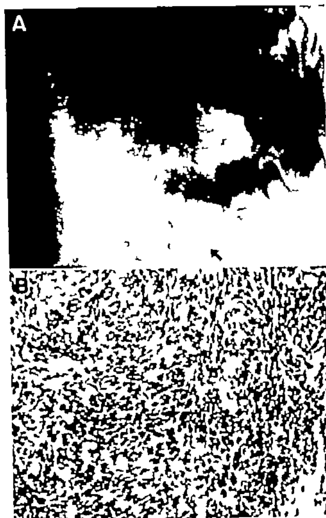


FIG. 81.—Fibrosarcoma of mandible. *A*, lateral roentgenogram *B* photomicrograph of biopsy specimen from same patient The tumor a rapidly growing neoplasm of fibroblastic origin, is extremely cellular Individual cells are spindle-shaped to rounded, nuclei variable in size, shape and staining reaction, many hyper chromatic; numerous mitotic figures are seen, × 100 (From Byars L. T and Sarnat, B G Surg., Gynec. & Obst. 83 355 1946)

2. The atypical symptom complex. An illness that fails to follow the usual clinical course either initially or subsequently may be due to cancer The usual diagnostic methods of history taking, physical examination, roentgenographic examination, biopsy and blood analyses are then ordinarily sufficient to indicate the possibility of the presence of cancer of a bone.

CASE HISTORY

H G White boy, aged 4 years

Chief complaint Swelling of left side of face for six weeks

Onset and course About eight weeks previously the patient suddenly complained of intermittent toothache in the left mandible and pain in the left ear Examinations by a dentist and by an otolaryngologist gave negative results An antibiotic was prescribed, apparently on an empiric basis About two weeks later a firm fixed mass about 2 × 1 × 0 5 cm. was first noted in the left mandible It has grown rapidly in the last few weeks

Physical examination A young boy, with marked asymmetry of the face, complains of pain Extraoral examination reveals on the left side a large hard, fixed, moderately tender mass which extends from below the lower border of the posterior part of the mandible up to the superior border of the ear The anterior portion of the ear is pushed out by the mass Intraoral examination reveals a mass arising from the mandible behind the last molar and pushing the left tonsillar area to the midline of the pharynx There are no carious teeth in the region

Tentative diagnosis Sarcoma of the mandible

Laboratory reports Biopsy—fibrosarcoma Roentgenogram—considerable destruction of the posterior part of the body and the ramus of the left mandible (Fig 81)

Final diagnosis Extensive fibrosarcoma of the left mandible

IN PATIENTS OVER 40, THINK OF CANCER FIRST

IN PATIENTS UNDER 40, THINK OF CANCER TOO



PLATE II—Noncancerous lesions of the oral cavity *Top left*, torus palatinus, an exostosis of the hard palate It seldom requires treatment and should be distinguished from palatal cysts, abscesses and tumors *Top right*, Vincent's infection of the palate, an acute process often associated with intraoral cancer Note the many ulcerated and membranous lesions *Center left*, aspirin burn of buccal mucosa, from local application of aspirin tablet for toothache Other white lesions to consider are leukoplakia, lichen planus, moniliasis and syphilis *Center right*, mucous patch at commissure of the mouth, a highly infectious, early lesion of syphilis characterized by a white firm area that may erode. Lymph nodes are enlarged, firm, discrete and painless *Bottom left*, fibroma of the floor of the mouth *Bottom right*, hyperplasia of gingival tissues from poorly fitting upper denture

XXX

Differential Diagnosis of Oral and Facial Lesions Noncancerous

Tumor and Tumor like Lesions

A benign tumor is characterized by its slow growth (Table 5 p 94) A limiting capsule is usually present. The growth rarely infiltrates locally and it does not spread to a distant region Even a benign tumor may cause death if it interferes with a vital function, as in the case of *pressure on the brain, trachea or a major blood vessel. Benign* tumors and tumor like lesions of the oral cavity can be conveniently grouped as (1) those related to soft tissue and (2) those related to bone (Table 9)

TABLE 9 —Classification of Noncancerous Oral and Facial Lesions

I. Tumors and tumor like lesions
  A. *Soft tissue*
    1 Cystic
      a) Mucous gland
      b) Ranula
      c) Naso-alveolar
    2. Solid
      a) Epithelial
        1) Salivary gland mixed tumor (pleomorphic adenoma)
        2) Nevus
        3) Papilloma
        4) Adenoma
        5) Gingival hypertrophy
          a) pregnancy
          b) Dilantin sodium
          c) fibromatosis
          d) artificial denture
      b) Connective tissue
        1) Fibroma
        2) Myxoma
        3) Lipoma
        4) Hemangioma
        5) Lymphangioma
        6) Myoma
        7) Neuroma
        8) Neurofibroma
        9) Peripheral giant cell tumor (epulis)

- B Bone
  - 1 Dental in origin
    - *a*) Solid
      - 1) Odontoma
      - 2) Cementoma
      - 3) Ameloblastoma
    - *b*) Cystic
      - 1) Follicular
      - 2) Dentigerous
      - 3) Ameloblastoma
      - 4) Radicular
  - 2 Nondental in origin
    - *a*) Solid
      - 1) Fibroma
      - 2) Ossifying fibroma
      - 3) Fibrous osteoma
      - 4) Osteoma
      - 5) Torus
        - *a*) palate
        - *b*) mandible
      - 6) Chondroma
      - 7) Giant cell tumor (central)
    - *b*) Cystic
      - 1) Incisive canal
      - 2) Median anterior maxillary
      - 3) Globulomaxillary
      - 4) Traumatic
- C Composite tumors
  - 1 Dermoid
  - 2 Teratoma

II Developmental lesions

- A Cystic
  - 1 Thyroglossal duct
  - 2 Lateral cervical (branchial cleft)
- B Solid
  - 1 Fibromatosis gingivae
  - 2 Median rhomboid glossitis
  - 3 Lingual thyroid

III Inflammatory lesions

- A Acute
  - 1 Aphthous stomatitis
  - 2 Herpes simplex
  - 3 Vincent's
  - 4 Abscess
  - 5 Osteomyelitis
- B Chronic
  - 1 Pyogenic granuloma
  - 2 Syphilis
  - 3 Tuberculosis
  - 4 Histoplasmosis
  - 5 Beryllioses
  - 6 Actinomycosis
  - 7 Abscess
  - 8 Osteomyelitis

IV Traumatic lesions

- A Dental irritations
- B Surgical injuries
- C Bites
- D Burns

V Endocrine and metabolic lesions

- A Diabetes mellitus
- B Hyperparathyroidism
- C Pregnancy
- D Vitamin deficiency
- E Dilantin sodium
- F Blood dyscrasias
- G Lipoid dystrophies

SOFT TISSUE LESIONS

The benign soft tissue lesions are largely solid except those cysts which arise from mucous glands particularly from the mucous membrane at the floor of the mouth (ranula) (Fig 82, *A*) cheek and lip (Fig 82, *B*) The solid ones can be classified into those which are essentially (1) epithelial in nature and (2) connective tissue in nature.

Epithelial tumors differential diagnosis—In trying to make a differential diagnosis the soft tissue lesions and structural aberrations must



FIG. 82.—Cystic soft tissue lesions *A*, ranula (arrow) arising from floor of the mouth. It must be removed completely or marsupialized mere incision and drainage will result in wound closure and re-formation of the mucous cyst. *T* indicates tongue. *B* mucous gland cyst of lower lip which followed an injury of the duct of the mucous gland and resulted in the cyst formation

also be taken into consideration The benign epithelial tumors such as the papilloma have been described. The adenoma is not common.

In contrast to the epithelial tumors are the sebaceous glands sometimes seen in the buccal mucous membrane and vermilion of the lips. They appear as raised yellow areas about 1 mm. in diameter (Fordyce s spots) Hyperplasia of the epithelium of the gingiva (including the subepithelial connective tissue) is sometimes found during pregnancy The condition disappears soon after termination of the pregnancy

Patients who take Dilantin sodium may show enlargement of the gingiva, which disappears with the cessation of the administration of the drug In patients with ill fitting dentures the gingival tissues may become enlarged (Plate II bottom right) In another condition known as congenital macrogingiva (fibromatosis gingivae) the gingiva is apparently enlarged at birth (Fig 83) All of these conditions must be



Fig 83 —Congenital macrogingiva and hypertrichosis In *A*, note massive gingival tissues which cause the lips to protrude and cover all but the incisal and occlusal surfaces of the teeth Normal mastication was impossible *B*, four months after surgical removal the gingiva has a more normal clinical appearance (From Byars, L T, and Sarnat, B G Surgery 15 964, 1944)

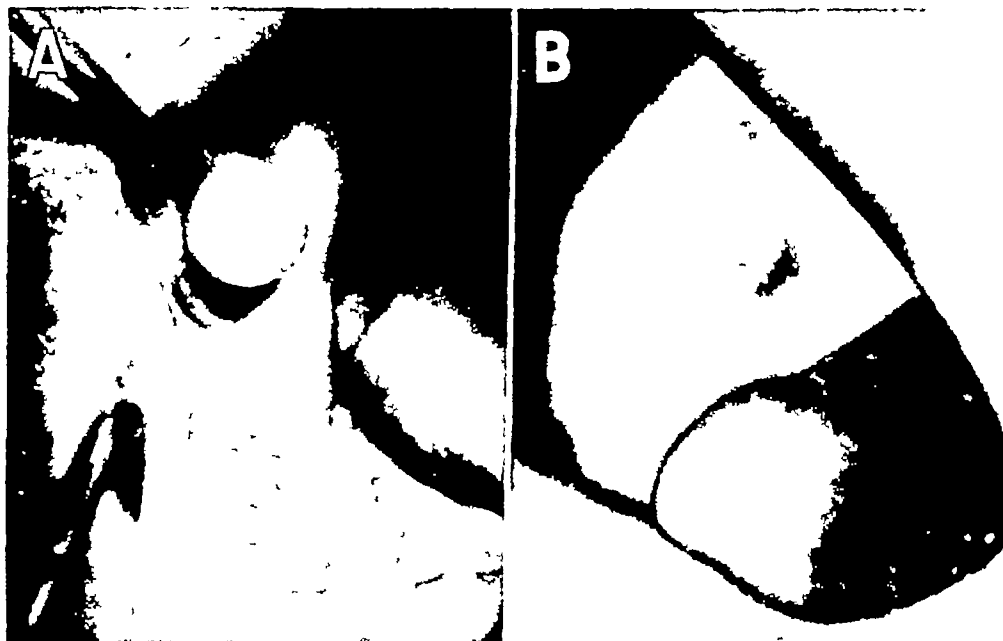


Fig 84 —Soft tissue tumors of the cheek *A*, pedunculated lipoma *B*, enlarged papilla of the parotid duct Microscopic diagnosis was "fibroma The papilla of the opposite parotid duct was much smaller

differentiated from the enlarged gingiva in leukemia (Fig 68, p 161)

In addition to general enlargement of the gingiva local areas of growth are also seen. The nonspecific term "epulis" has been applied to individual growths of the gingiva On histologic examination it may be found to vary in structure, containing giant cells and fibrous vascular or other tissue.

The mixed tumor (pleomorphic adenoma) may occur in the parotid gland (Figs 27 *D* p 77 and 67 p 159) the submandibular gland, the palate (Fig 64 p 154) lip cheek or tongue. There is much confusion concerning the composition of this tumor It may sometimes become malignant (see Chap XXII)

Connective tissue tumors —Benign connective tissue tumors may occur wherever the particular tissue of origin is present Thus a lipoma or fibroma may be found in the cheek (Fig 84) a myoma in the tongue a neurofibroma along a nerve, a fibroma of the floor of the mouth (Plate II, bottom left) or a hemangioma of the lip the floor of the mouth or the tongue (Fig 94, *E* and *F* p 212)

BONE LESIONS

The central benign tumors of the jaws are similar to benign tumors of the bones found elsewhere in the body In addition, a group of tumor and tumor like lesions of dental origin are also found in the jaws

Jaw lesions of dental origin —The dental lesions may be grouped into the solid type (ameloblastoma, odontoma, cementoma) and the cystic type (follicular dentigerous, radicular cysts cystic ameloblastoma) None of these ever becomes malignant, with the possible but rare exception of the ameloblastoma.

ODONTOMA.—The odontoma may contain from one to many irregular calcified bodies composed of enamel, dentin and cementum arranged in bizarre patterns This tumor develops when the tooth forming organs are active and its growth stops with the cessation of activity of the formative cells Clinically many of these growths are found during routine roentgenographic examinations. The outline of the odontoma and its components may be seen on the roentgenogram (Fig 85)

FOLLICULAR CYST —The follicular cyst is a result of the cystic degeneration of the tooth germ. When the crown of a tooth is included in the cyst it is known as a dentigerous cyst. The roentgenogram is an aid in diagnosis (Fig 86)

AMELOBLASTOMA.—The ameloblastoma is derived from the cells of the odontogenic epithelium (dental lamina, enamel organ) (51) It is

attempts to remove the tumor Secondary infection of the tumor and fistulous tracts leading to the oral cavity, face or neck are not uncommon complications.

With growth of the tumor, the jaw increases in size The buccal plate displaces the cheek, and the lingual plate displaces the tongue to the opposite side of the mouth The bone is sometimes so thinned that it will crack like an eggshell The patient may be seen only after path-

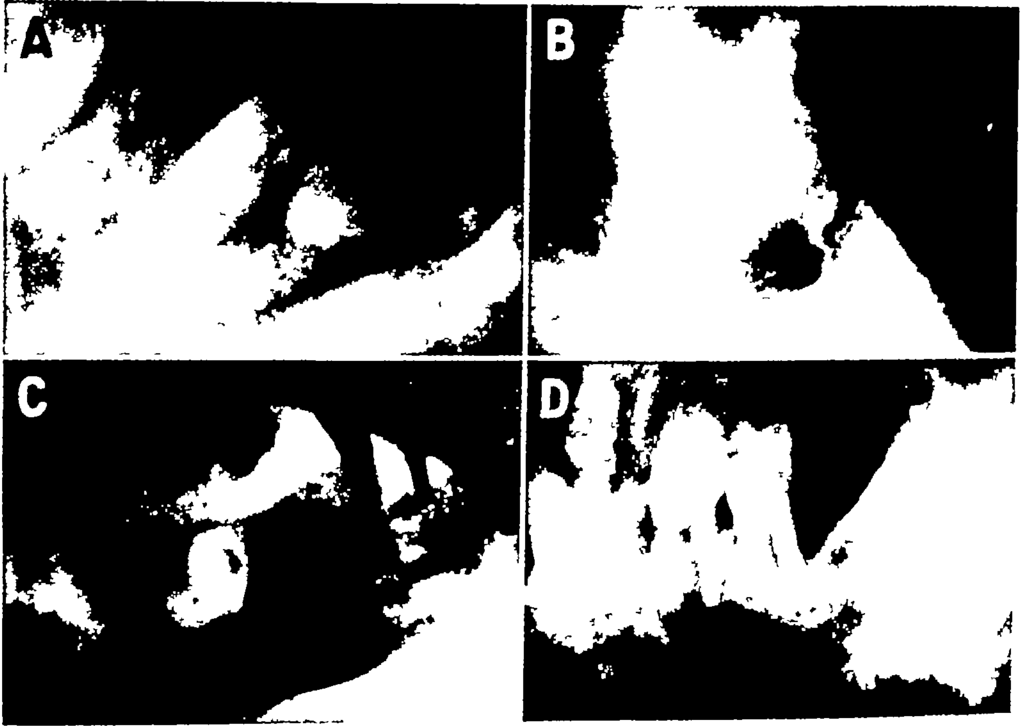


FIG 88 —Ameloblastomas of the mandible All showed different roentgenographic characteristics but similar microscopic picture (*D* from Thoma, K *Oral Pathology* [4th ed , St Louis C V Mosby Company, 1954])

ologic fracture has occurred These are late changes and occur after the tumor has changed from the solid to the cystic phase Only occasionally do true signs of malignancy appear

The roentgenogram is valuable in the diagnosis of radiolucent lesions of the jaw The final diagnosis, however, depends on the gross and particularly the microscopic examinations The roentgenogram is most valuable for early diagnosis of an ameloblastoma of the jaw when the tumor is still centrally located and in the solid phase and has not yet increased the size of the bone At this time most of the mandible is not yet destroyed and the tumor can still be completely removed



Fig. 89 —Tumor ... distortion of the ... process. C section ... tumor (From B... 1945)



lesions which appear radiolucent. A, dental outlined area related to mesial root of the e at time of surgical removal. B dental peri ly outlined area related to distal root of the d in mesial root. Diagnosis was made at time t in upper central incisor region, of develop- e teeth. D traumatic cyst in lower re- found on surgical ration

without serious deformity When the ameloblastoma has become cystic and considerably larger, the clinical evidence is obvious and the roentgenogram is of primary value in showing the extent of bone destruction (Fig 87, *C* and *D*) There is no constant characteristic roentgenographic description of the ameloblastoma (Fig. 88) The multilocular appearance and the scalloped border are by no means pathognomonic The ameloblastoma, giant cell tumor, carcinoma and other destructive lesions cannot be positively differentiated on the basis of the roentgenogram alone (52)

The findings on gross examination vary with the stage of development of the ameloblastoma Combinations of the solid and cystic tumors are found in varying degrees The solid tumor, which usually represents an earlier stage of development, is of fine granular consistency and encapsulated. There may be one principal mass with numerous smaller daughter areas The solid tumor frequently undergoes cystic degeneration (Fig 89). The contained fluid may be clear yellow to red and of either mucous or serous nature The bone is enlarged and may be as thin as parchment

Curettage, cauterization with drugs and irradiation are inadequate therapeutic measures. The lesion should be (1) completely enucleated if unilocular, (2) cauterized by heat if not too large and multilocular, or (3) resected with a small amount of normal bone if extensive These are the best methods of treatment because they give the greatest assurance that no tumor is left

RADICULAR CYST —The radicular cyst, although environmental rather than developmental in origin, usually occurs at the root end of the adult tooth The pathologic process is as a rule that of caries of the enamel and dentin with subsequent exposure and death of the dental pulp This infection spreads to the root end of the tooth and eventually causes the formation of a granuloma (Fig 90, *A*) Sometimes the granuloma undergoes cystic change to form a root-end cyst, which may become secondarily infected and eventually drain (Fig 90, *B*) On the roentgenogram the periapical granuloma and root-end (radicular) cyst appear radiolucent, and one is not always able to distinguish between them (Fig 90)

Jaw lesions originating in bone—The benign bone lesions of non dental origin can be grouped into solid and cystic types.

SOLID TUMORS —These are similar to those found in bone elsewhere Mention should be made of the torus palatinus (Fig 91, *B*, and Plate II, top left) and mandibularis (Fig 91, *A*), which have been consid

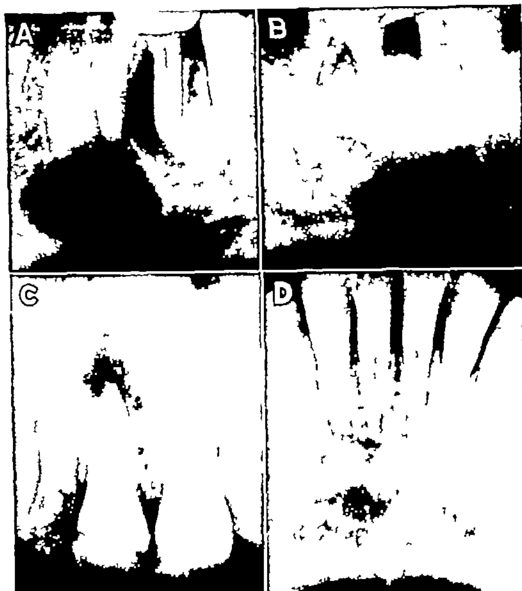


Fig. 90.—Roentgenograms of jaw lesions which appear radiolucent. *A*, dental periapical granuloma. Note sharply outlined area related to mesial root of the lower first molar. Diagnosis was made at time of surgical removal. *B* dental periapical or radicular cyst. Note sharply outlined area related to distal root of the lower molar and radiopaque material in mesial root. Diagnosis was made at time of surgery. *C* anterior palatine cyst in upper central incisor region, of developmental origin and not related to the teeth. *D* traumatic cyst in lower incisor region. Usually no lining membrane is found on surgical exploration.

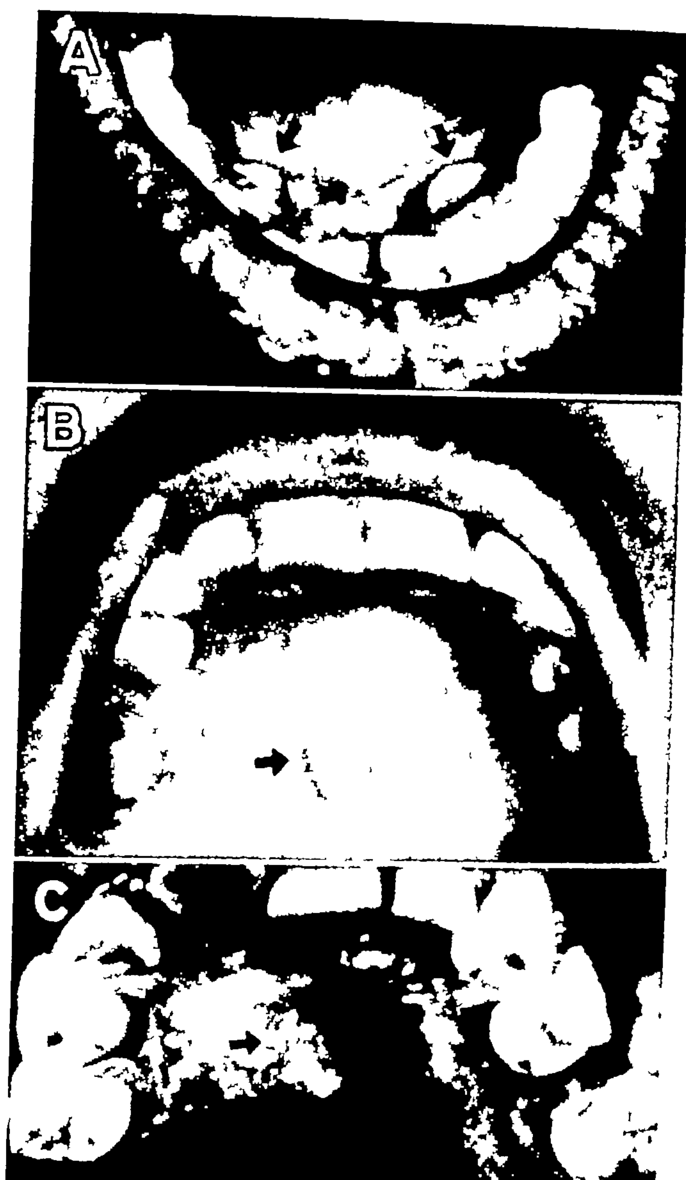


Fig 91 —*A*, bilateral mandibular tori on lingual surface in cuspid region *B* midline torus of hard palate, to be differentiated from palatal abscesses and cysts, mixed tumors and carcinoma *C*, palatal abscess from periapical infection of an upper incisor

ered by some to be tumors. These bony exostoses need no treatment un less they interfere with normal function or with the construction of proper artificial dentures, or unless the mucosal surface becomes trau matized, inflamed or ulcerated. Palatal abscess (Fig 91 *C*) cyst and mixed tumor (Fig 64, p 154) must be considered in the differential diagnosis.

Giant cell lesions are also found in the jaws The peripheral giant cell type, sometimes incorrectly termed epulis is related to the teeth and is usually a single lesion (Fig 92) The central giant cell type however



FIG. 92.—Peripheral giant cell lesion of the mandible back of the lower bicuspid. This is usually related to the periodontal membrane As the mass increases bone is resorbed, the tooth becomes loose and eventually is lost. The roentgenogram revealed local bone destruction. Roentgenograms of skull long bones pelvis and spine revealed no destructive lesions Serum phosphorus, calcium and protein val ues were within normal limits.

may be either single (Fig 116 p 253) or multiple and found in other bones.

NONDENTAL BONE CYSTS —The nondental bone cysts are found most frequently in the maxilla and are located in regions of fusion of the palatal processes (Fig 90 *C* and Table 11 p 219) The traumatic cyst (Fig 90 *D*) is found more often in the mandible It has no epithelial lining and the cavity may be filled with the degradation products of blood. The diagnosis is usually made at the time of operation.

COMPOSITE TUMORS

THE COMPOSITE TUMORS consist of more than one germ layer The dermoid, which is not a common tumor is an example. It is seen most

often in the midline in the floor of the mouth, either below or above the mylohyoid muscle

Developmental Lesions

Certain developmental lesions in the mouth and neck must be differentiated from cancer (Table 9, p. 197) Median rhomboid glossitis (Fig. 93, *B*) is sometimes mistaken for cancer by those unacquainted with this condition It is an embryologic remnant (tuberculum impar) occurring in the midline at the posterior part of the dorsum of the tongue The surface is elevated, devoid of papillae, irregular and may be roughly rhomboid in shape Because there is no inflammation, the use of the term glossitis is incorrect It is not ulcerated and exhibits none of the true characteristics of cancer No treatment is necessary This is also true of the foliate papillae which are rudimentary in the human being and are found occasionally on the posterolateral surface of the tongue

Fibromatosis gingivae is shown in Figure 83 (p 200), and thyroglossal duct cyst (Fig 32, *A*, p 99) and the lateral cervical cyst (Fig 32, *B*) are discussed on pages 97 and 100

The foramen caecum marks the site of the origin of the thyroid gland When the gland fails to descend during embryologic development, it may be found at the base of the tongue and it appears as a tumor. In about 70 per cent of the patients with lingual thyroid nodules, there is an absence of thyroid tissue in the neck Because of an increase in size and the position of the tumor, it may obstruct the oral pharynx

Inflammatory Lesions

Inflammatory lesions may be classified generally into the acute, those which last for a short time, and chronic, those present for a long time. There should usually be no trouble in distinguishing an acute inflammation from cancer because the former should disappear in two to three weeks It is important to remember, however, that cancer may be secondarily infected, and if the superimposed inflammation improves, one might mistakenly believe that it is the cancer which is resolving

Acute lesions—Swelling and ulceration occur in both acute and chronic infections and are also frequently associated with cancer

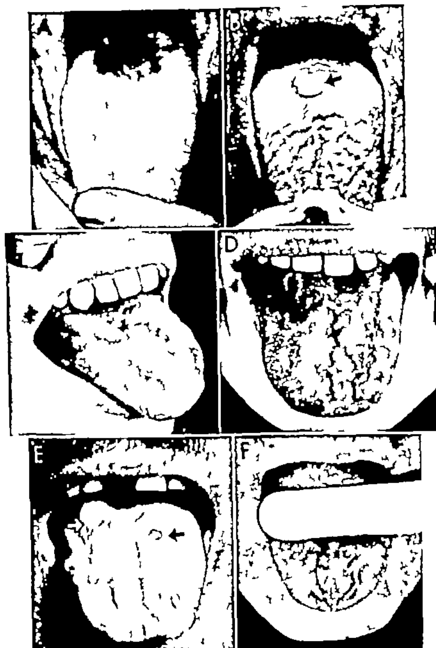


FIG. 93.—Noncancerous lesions of tongue. *A*, hairy tongue. Papillae on posterior third are elongated. The lesion, of unknown cause, is not serious; local treatment is directed toward removal. *B*, median rhomboid glossitis in midline of posterior part of dorsum. *C* and *D*, geographic tongue (glossitis migrans). The lesions, usually symptomless, lack filiform papillae and form irregularly circular zones that merge and produce a maplike appearance. There is no specific treatment. *E*, mucous patch of the dorsum, a highly infectious early lesion of syphilis, characterized by white, firm, painless area which may erode. Lymph nodes are enlarged, firm, discrete and painless. *F*, tuberculous ulcer, a chronic, painful, indurated lesion. Biopsy, sputum study and roentgenogram of the chest confirmed the diagnosis.

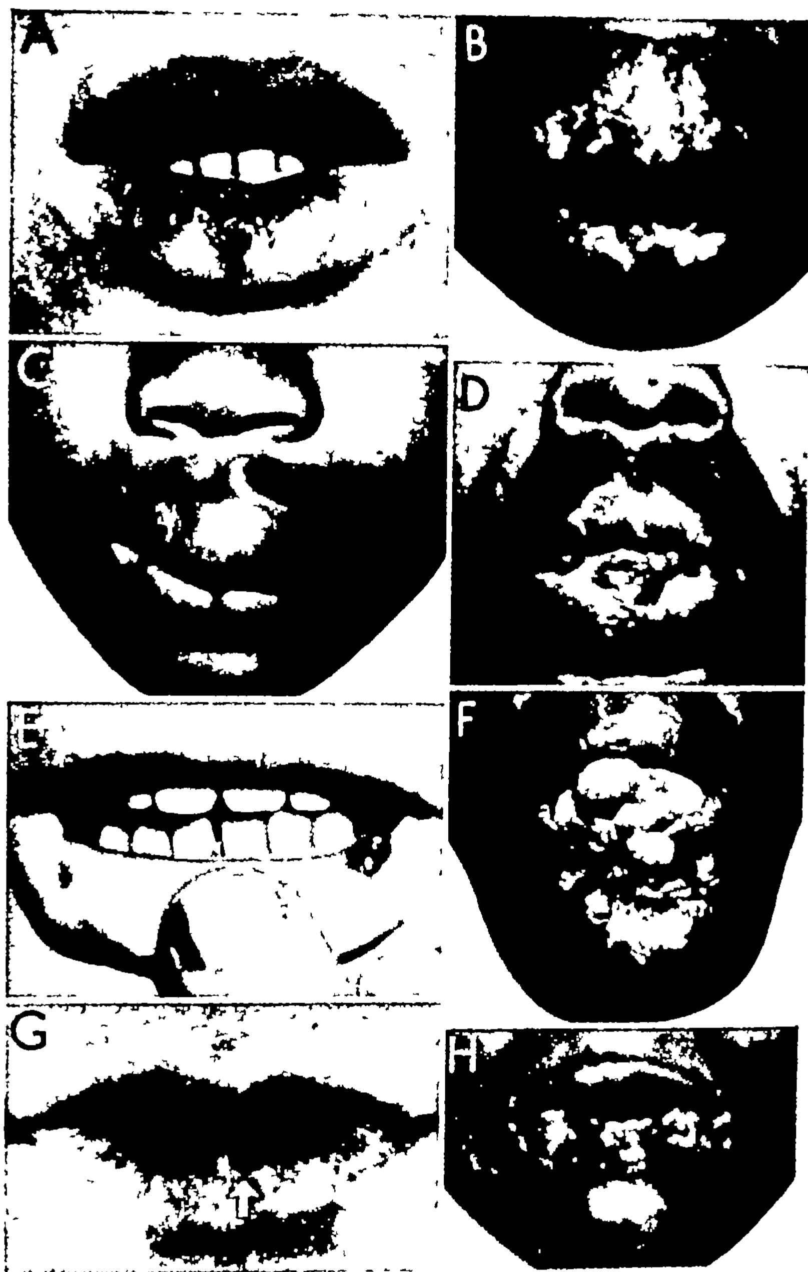


FIG 91—Noncancerous lesions of lips *A*, herpes simplex, usually acute and nonrecurring, characterized by thick-walled vesicles which rupture and form crusts It disappears in 7-14 days *B*, dermatitis venenata in patient sensitive to lipstick Note acute reaction—swelling, serous exudation, crusting *C*, furuncle, an acute condition Note swelling with central ulceration *D*, chancre, a primary lesion of syphilis, highly contagious, painless and indurated Dark-field examination of smears should reveal spirochetes Regional lymph nodes are enlarged, firm, discrete painless Wassermann serologic reaction may be negative in the early stage *E*, small hemangioma, a small tumor readily treated by surgery *F*, large hemangioma of lip, floor of mouth and tongue, present since birth, which has grown in proportion with body *G*, benign melanoma a small, nonelevated, black lesion, present for many years without change It occasionally becomes malignant *H*, human bite

Herpes simplex of the lip (Fig 94 A) aphthous stomatitis and Vincent s infection (Fig 95 and Plate II top right) are acute ulcerative conditions which must be considered. The history physical examination and clinical progress of the patient should usually permit one to rule out cancer If however the lesion has not cleared up in two to



FIG. 95 —Ulceromembranous stomatitis (Vincent s) The ulcer of cancer of the mouth is usually invaded by Vincent s organisms Because of this, diagnosis of cancer is sometimes missed and only that of Vincent s infection made. Note under surface of tongue gingiva and lips Compare with Figure 20 E (p. 67)

three weeks, it should be considered to be cancer until absolutely ruled out.

Oral and facial abscesses are usually secondary to infections of the teeth and jaws. In the mouth, pathogenic organisms are introduced to the jaws through the separation between the gingiva and the teeth (lateral abscess) or as a result of dental caries with infection and death of the pulp with a spread to the root end region (periapical abscess and osteomyelitis) The direction of the spread (intraoral or extraoral) of the abscess will depend on the particular location in the upper or lower jaw of the tooth roots and their relationship to muscle and fascial planes These swellings must be considered in the differential diagnosis (Fig 27 A, p 77) The acute phase may extend into a chronic one characterized by a formation of a periapical dental granu

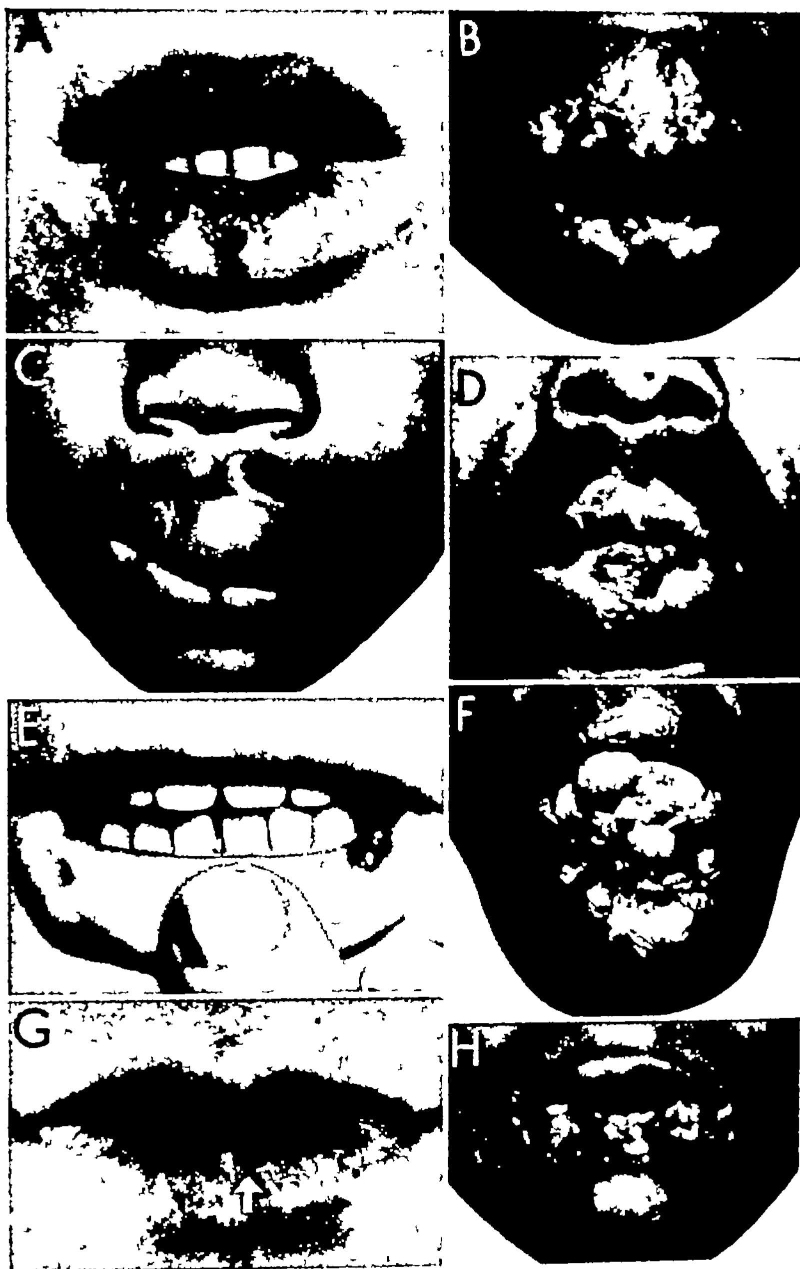


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loma, cyst, abscess or chronic draining sinuses opening into the mouth or onto the face or neck A patient with a chronic sinus (draining or not) of the skin of the face or neck should be examined to see whether a dental infection is the possible source

Chronic lesions —OSTEOMYELITIS —Osteomyelitis of the jaws is more often a result of local, rather than systemic, factors The acute type is frequently secondary to infection of the dental pulp but may also result from a retained dental root or fractures of the jaws Although the acute type may become chronic, the latter is more commonly associated with secondarily infected cysts, heavy metal poisoning, various radiations, tuberculosis, syphilis and actinomycosis In chronic osteomyelitis there may be acute recurrent exacerbations. In the presence of the teeth the periodontal structures serve as a pathway for the spread of infection Seldom does osteomyelitis begin in the edentulous jaw

In acute osteomyelitis, roentgenographic evidence may not be found during the first few weeks In chronic osteomyelitis, however, destruction of bone may be seen in the roentgenogram (Fig 76, p. 181) Malignancies of the bone also show evidence of destruction on the roentgenogram and should be considered in differential diagnosis (Figs. 75, p 180, 79, p 187, and 80, p 188).

PYOGENIC GRANULOMA.—Pyogenic granuloma is a chronic inflammatory condition found most frequently on the gingiva but also on the tongue, lip, palate and cheek It is an elevated, lobulated, ulcerated, purplish-red tumor-like mass, which bleeds readily upon slight trauma. Therapy should be directed toward removal of possible local irritating factors The lesion itself may be excised or destroyed by means of electrocautery Even after apparently complete removal or destruction, the condition may recur

TUBERCULOSIS —Oral and cervical tuberculosis must be considered in the differential diagnosis of cancer The tuberculous ulcer is, in rare instances, seen on the tongue (Fig 93, *F*) It is usually of long duration, may be quite painful and it may appear after trauma, such as biting of the tongue Although the tuberculous ulcer may have certain clinical characteristics, these are variable The diagnosis should be made only on microscopic examination of biopsy tissue Tuberculous ulcers are usually secondary to far advanced pulmonary tuberculosis. Local implantation and establishment of the tubercle bacillus result in the production of the ulcer. A roentgenogram of the chest should be taken and the sputum should be examined in every patient with either oral or cervical tuberculosis

In addition to tuberculous ulcers of the mouth, enlargement of submandibular and cervical lymph nodes due to tuberculosis should be considered (Fig 32, C p 99) These nodes are usually multiple and matted together They are not as firm and as fixed as are lymph nodes which have been invaded by cancer

SYPHILIS.—Ulcers of the oral cavity and enlargement of regional lymph nodes are also found in patients with syphilis. The history dark field examination, serologic tests and biopsy should establish the diag nosis The chancre (Fig 94, D) and mucous patch (Fig 93 E and Plate II, center right) of early syphilis are not chronic lesions as is the gumma of late syphilis Many lesions of late syphilis are deceptive and may resemble cancer

SIALADENITIS.—Suppuration of the salivary glands may be acute or chronic. The acute type is found most frequently in the parotid gland of debilitated patients The onset is sudden. The gland becomes swollen and hard, and the resultant pressure on the facial nerve may cause a palsy Fluctuation may not be obtained because of the toughness of the parotid fascia. The papilla of the opening of the parotid duct is swollen and red, and a thick purulent discharge can be noted. To produce the latter slight pressure on the parotid gland may be necessary The appropriate antibiotics should be administered. If incision and drainage are necessary a vertical skin incision should be made along the anterior border of the external ear The anterior border of the wound is retracted, and by blunt dissection in a horizontal plane, in order to avoid the facial nerve entrance is gained into the gland through the capsule. Drains are inserted, the wound closed in part and a pressure dressing applied.

Chronic suppuration is found most frequently in the submandibular salivary gland. This is usually found associated with calculi or mucous plugs within the gland or duct, or both. Depending upon the size, loca tion and number of calculi partial or complete obstruction of salivary outflow may occur Swelling and pain in the gland and surrounding area occur at mealtimes because of the accumulation of the saliva produced. Where possible, stones in the duct should be removed intra orally Sometimes with smaller stones dilatation of the duct may aid their being expelled. With removal of the obstruction to salivary flow the infection will usually subside When the calculi are within the gland, it may have to be extirpated by the extraoral submandibular route.

Traumatic Lesions

Although the oral tissues are subjected to almost constant irritation by physical and chemical agents, serious sequelae are relatively uncommon The resulting inflammatory reactions are usually destructive in nature Hyperemia, edema and ulceration frequently occur. The tissue may also become hypertrophic, hyperplastic or hyperkeratotic The lesion will vary according to, not only the nature, duration and intensity of the irritant, but also the reaction of the local tissues In Table 10 most of the factors are listed Proper treatment requires the discovery and removal of the etiologic agent After this has been done, the lesion will frequently disappear without further treatment other than proper oral hygiene Occasionally excision or electrocautery destruction of the proliferative tissue is necessary

Some patients have the habit, particularly when under nervous tension, of sucking the buccal mucosa between the maxillary and mandibular teeth and chewing on it This results in superficial ulceration and scarring Removal of the cause will permit the lesion to heal

The chronic irritation of the gingivae of the alveolar ridge or buccal sulcus by a poorly fitting artificial denture provokes a hyperplasia of the tissue This same response occurs when there is a lack of adaptation of the upper artificial denture to the palate Removal of the prosthesis for several weeks will permit the hyperplastic tissue (granuloma fissuratum) to shrink considerably, or even completely Excision of any remaining excessive tissue and accurate approximation with sutures is then less of a problem

The history and examination should usually be adequate to diagnose lesions due to dental irritation (rough teeth, poor restorations, Fig 70, *D*, p 166), bites (Fig 94, *H*) or surgical trauma (Fig. 96). Although these lesions are not malignant, under special circumstances some of them may undergo malignant change (Fig 36, *B*, p 113)

Metabolic and Endocrine Lesions

In pregnancy, diabetes mellitus and vitamin C deficiency, there may be an enlargement of the gingiva In pregnancy and hyperparathyroidism there may be local tumor-like formations in the gingiva In any of these conditions the teeth may also become loose Radiolucent areas are sometimes found in the jaws in sickle cell anemia and the lipoid dystrophies Eosinophilic granuloma, which is probably related to the

TABLE 10 – PHYSICAL AND CHEMICAL CAUSES OF ORAL LESIONS

A. Physical
  1 Bites
    a) Accidental
    b) Habitual
    c) Convulsive (epilepsy eclampsia, etc.)
  2. Blows
    a) Animate
    b) Inanimate
  3. Falls
  4 Poor oral hygiene
    a) Rough teeth
    b) Dental caries and calculus
    c) Rough dental restorations
      1) Fillings
      2) Clasps
      3) Dentures
  5 Foreign bodies
    a) Coarse food
    b) Toys
    c) Occupational agents
      1) Intentionally introduced (tacks, nails, pins)
      2) Unintentionally introduced (sand and other irritants)
    d) Missiles
  6. Thermal agents (extremes of heat or cold, particularly in foods)
  7 Electricity
    a) Electrogalvanic (dissimilar metals in fillings)
    b) Biting of electric wires
  8. Radiation (x gamma, etc.)
  9 Surgical treatment

B Chemical
  1 Dentifrices and mouthwashes
  2. Alcohol
  3. Tobacco and tobacco products
  4 Corrosives and caustics (hydrochloric and other acids lysol, sodium hydroxide tincture of iodine silver nitrate mercurials aspirin, etc.)

latter has been reported in the jaws It is first noted as a destructive area on roentgenograms taken routinely

CLASSIFICATION OF "CYSTIC" LESIONS OF THE JAWS

Any practical clinical classification of "cystic" lesions of the jaws should be all inclusive Many errors are made in the clinical diagnosis of jaw tumors (Fig 23, p 72) The histopathologic diagnosis is spe-

cific The roentgenographic diagnosis, however, is nonspecific and includes many tumors which are radiolucent but not truly cystic Consequently, in the differential diagnosis all the lesions listed in Table 11 should be considered on a roentgenographic basis

To the surgeon and dentist this classification is more valuable than one developed on a strict pathologic basis of truly cystic lesions It is important for the dentist to realize that "cystic" lesions of the jaws can be other than dental in origin They may be metastatic rather



Fig 96—Perforation of soft palate, caused accidentally during tonsillectomy It should not be confused with gumma, which more often causes perforation of the hard palate

than primary in the jaws Consequently, it behooves the dentist and dental surgeon to be fully cognizant of the variety of "cystic" lesions of the jaws and to make early provision for adequate treatment. By the same token, the oral surgeon must be prepared at the time of operation to do either a relatively simple enucleation of a true cyst or a difficult radical resection of the jaw for a malignant tumor

Suggested Diagnostic Procedure

The following clinical factors should be considered in the differential diagnosis of oral and facial cancer

1 How long has the lesion been present? If it is of recent origin, i e, has been present only a few weeks, cancer should be considered

If the lesion has been present for many years one must then determine the answer to the next question.

2. Has there been a sudden increase in size of the growth? If there has been a sudden increase in size cancer must be considered. However in pregnancy and other metabolic conditions there may be an increase in size not related to cancer Thus, both recent and chronic

TABLE 11 —Classification of Radiolucent Lesions of the Jaws

I Dental origin
- A. Follicular cyst
- B. Dentigerous cyst
- C. Ameloblastoma
- D Granuloma
- E. Radicular cyst
- F Periapical ossifying fibroma

II Nondental origin
- A. Primary in jaws
  - 1 Benign
    - a) Anterior palatine cyst
    - b) Globulomaxillary cyst
    - c) Traumatic cyst
    - d) Osteomyelitis
    - e) Fibroma
    - f) Giant cell tumor
    - g) Eosinophilic granuloma
  - 2. Malignant
    - a) Carcinoma (local spread)
    - b) Sarcoma (fibrosarcoma, osteogenic sarcoma, Ewing's)
- B Secondary in jaws
  - 1 Metastatic carcinoma and sarcoma
  - 2. Altered body metabolism
    - a) Hyperparathyroidism
    - b) Reticuloendothelial disturbances (Gaucher's, Christian-Schüller etc., eosinophilic granuloma)

lesions which are rapidly increasing in size are to be considered cancerous until proved otherwise, and biopsy should be done immediately

If a lesion which was previously considered to be benign suddenly shows signs of either increased or abnormal growth, its nature should be determined at once by microscopic examination of a biopsy specimen.

3 What is the consistency of the lesion? Usually cancerous lesions are quite firm

4. Is the lesion fixed to the surrounding tissue? Because cancer has no sharp boundaries, it grows into infiltrates, destroys and replaces the surrounding tissues in all directions Consequently when the

dermis and subcutaneous tissues are infiltrated, the mass is fixed to the overlying skin Benign tumors are enclosed in a capsule, do not infiltrate and consequently are usually freely movable. This, of course, does not apply to tumors of bone

5 Are the regional lymph nodes palpable? Oral cancer frequently spreads not only locally into the tissue but also to the regional lymph nodes via the lymphatics These lymph nodes are stony hard If the capsule of the lymph node has been invaded and broken through by the cancer cells, the node becomes fixed to the surrounding tissues Such a lymph node should be considered to be cancerous unless proved otherwise The first clinical indication of oral cancer may be in the lymph nodes of the neck.

Lymph nodes which are enlarged, tender, soft and movable are probably involved in an inflammatory process

6 Has the lesion responded to treatment? If after treatment a lesion persists, one should always think of cancer Any lesion whose nature is unknown and which has not healed in three weeks should be examined by biopsy

Questions for Students

1 What is a neoplasm?
2. What are the characteristics of a benign neoplasm? What are the characteristics of a malignant neoplasm?
3 What is your understanding of the term "precancerous"?
4 What are some precancerous lesions?
5 How should precancerous lesions be treated?
6 What is leukoplakia?
7 How should it be treated?
8 Should dentures be placed over areas of leukoplakia?
9 What should one avoid who has leukoplakia?
10 Should all small pigmented spots around the face be removed as a *routine practice?*
11 What are the chances for the "so-called birthmark" becoming malignant?
12. Under what conditions does a benign tumor become malignant?
13 Are chronic recurrences of herpes labialis likely to become malignant?
14 How early in life has cancer of the oral cavity and face been diagnosed?
15 To where does cancer of the mouth and face metastasize?
16 What tumors metastasize to the jaws?
17 Classify cancer
18 What are the differences between sarcoma and carcinoma?
19 Do malignant bone tumors of the jaws originate as such or are they the result of metastasis?
20 Why *should Wassermann and Kahn tests* of the blood be made of each patient suspected of having cancer?
21 Why is early diagnosis of cancer important?
22. Why is the dentist so important in the cancer control program?
23 What are the dentist's responsibilities in regard to oral cancer?
24. How can cancer be detected?
25 What advantages does the dentist have over other specialists in the diagnosis of cancer?
26 Why is a complete examination of the face, neck and oral cavity essential in the diagnosis of cancer?
27 What constitutes a complete oral examination?
28 Why is it important for both the dentist and the physician to do a complete oral examination on every patient?
29 How does one arrive at a diagnosis of cancer?
30 What characteristics of lesions of the mouth and face would make you suspicious of a malignant tumor?
31 What are the possible causes of loose teeth?
32. What is the relation of pain to cancer?
33. What different types of pain are there?
34. When does pain appear in cancer?
35 What steps should be taken to confirm a clinical impression of a malignant tumor?
36 If a mouth lesion is found to be malignant, is it possible to determine whether it originated in the mouth or as the result of metastasis?

37 How do you make a diagnosis of cancer when it is within the bone?
38 What would be the value of an early diagnostic test for cancer?
39 Why is microscopic examination of tissue essential?
40 What is a biopsy?
41 Who should take a biopsy of a suspected lesion?
42 Describe the technic of a biopsy
43 Should a local anesthetic agent be injected into the cancer to be biopsied?
44 What information should be given with tissue sent in for microscopic examination?
45 In what solution should the biopsy specimen be placed?
46 Where can a biopsy specimen be sent for examination?
47 What is a frozen section? Advantages? Disadvantages?
48 Should all lesions be biopsied?
49 What can be determined from the microscopic study of a biopsy specimen?
50 What is a negative biopsy?
51 In a biopsy positive for cancer, what are the microscopic findings?
52 In addition to discovering whether a tumor is benign or malignant, are there any other reasons for microscopic examination?
53 To what extent does a biopsy predispose to the changing of a benign tumor to a malignant tumor?
54 Will biopsy of a malignant lesion stimulate growth or metastasis?
55 Would you advise scaling teeth and trying to treat chronic ulcer of the mouth before taking a biopsy?
56 What is the Papanicolaou test? What value would it have in regard to the mouth?
57 Should a patient be told that he has cancer? How does one tell a patient that he has cancer?
58 What is cancerophobia?
59 What procedure should be used to refer a patient with cancer for treatment?
60 Which type of oral cancer offers the best prognosis?
61 Which type of oral cancer offers the poorest prognosis?
62 Why is there no cancer of either the enamel or dentin?
63 Is cancer found in the dental pulp?

PART III

Treatment of Oral and Facial Cancer

XXXI

Primary and Secondary Treatment of Cancer

THE PATIENT the first important link in the cancer control program must be aware of the early clinical signs and symptoms of possible cancer He then consults the family dental or medical practitioner for diagnosis and advice. The family doctor constitutes the second impor tant link in the cancer control program. If he diagnoses cancer the patient is referred immediately to the specialist for treatment. The specialist is the third and last important link in the cancer control program. Successful treatment of cancer depends on early diagnosis when the growth is still small and contained locally Any treatment which fails to eliminate the cancer in its entirety is inadequate.

Primary treatment —There are only two recognized methods of treat ment of oral and facial cancer surgery and irradiation (1 4 7 12) They may be used separately or in combination, depending on the type and location of the tumor as well as the condition of the patient. The judgment and experience of the specialist consulted are important. Consequently the treatment of choice is in part determined by whether the best qualified specialist available to the patient is a surgeon or a radiotherapist.

The objectives in the treatment of oral cancer should be the main tenance of as nearly normal life as possible for the longest period of time. This means that the patient s general health, oral function and appearance should be minimally impaired

Certain standards have been devised for the clinical evaluation of the effectiveness of cancer treatment Generally five years is consid ered to be a relatively reasonable survival period after treatment for cancer There are, however many more five year survivals among pa

tients with cancer of the skin than among those with cancer of the floor of the mouth Series of patients treated for cancer have been analyzed according to "five year cure," "five year survival with evidence of disease" and "five year survival without evidence of disease"

There are numerous objections to the expression "five year cure" (1) Once a cancer has been diagnosed the patient should always be re-examined periodically, regardless of how successful the treatment appears to have been The possibility of either persistence or recurrence of the growth must always be kept in mind (2) The term does not designate specifically whether there is evidence of the disease at the end of the five year period The expressions "five year survival with evidence of disease" and "five year survival without evidence of disease" are more specific. Analysis according to the latter gives a better indication of the results of treatment

The value of methods other than surgical removal and irradiation in the treatment of cancer has not been demonstrated (58) Nothing has yet been discovered in the way of diet, pills, salves, vitamins, glandular products and other means which will cure cancer, and to waste both time and money on them is missing an opportunity for a possible permanent cure To use these unscientific measures is to mistreat the cancer, and mistreated cancer has a 100 per cent mortality The only known treatment for cancer is the complete destruction or removal of all the cancer cells

Secondary treatment—After the patient has been treated primarily by either surgery or radiation, secondary care is frequently necessary If either deformity or dysfunction is produced, surgical reconstruction (plastic surgery) or prosthetic reconstruction may be necessary Surgical repair is usually not undertaken until it has been determined that the cancer therapy has been effective In the meantime a prosthesis can be worn Treatment should not be considered complete until there is a satisfactory restoration of both function and appearance Various complications may arise which need attention The dentist can play an integral part in the patient's oral care

XXXII

Surgical Treatment of Oral and Facial Cancer

THE METHOD by which surgery accomplishes its purpose is obvious Either the complete removal or the destruction of all cancer cells is required. This may be accomplished by excision by use of cold steel or electroknife, rongeurs and saws or by electric or thermal destruction of the growth. Chemosurgery has been established on a more scientific basis in recent years The method consists in fixing the suspected tissue by means of chemicals excising this area and then studying many sections of the specimen under the microscope. In this way the presence or absence of cancer can be determined in a particular area. The procedure is repeated until the growth has been completely removed.

Treatment can be accomplished most readily and most satisfactorily when the growth is small and localized. When the growth is large and has spread, either locally or to a distant site complete removal is more difficult and less successful. To insure complete removal of cancer it is necessary to remove a certain amount of normal tissue beyond which, on the basis of clinical judgment, it is believed the cancer has not spread If a single cancer cell remains it will continue to grow and multiply and the treatment is a failure.

Cancer surgery must be radical surgery If the surgeon does not eliminate the cancer the cancer will eliminate the patient. It is far better to have a permanent recovery with some impairment than to have an immediate good cosmetic result followed by an early death.

Surgical treatment is required not only for the primary oral or facial lesion but also for the cancer which has spread beyond the oral cavity and face. Because carcinoma travels through the lymphatic channels

(Figs 65 and 66, p. 158), surgical procedures have been devised to remove these tissues Consequently, a neck dissection, a procedure whereby all cancer-bearing tissue originating from either the mouth or the face is removed, may sometimes be a more formidable procedure than local removal of the primary lesion

Cancer of the lip and skin of the face spreads to the neck late and



Fig 97 —Incisions for complete unilateral neck dissection Horizontal incision extends from the mastoid process to opposite side of the chin and passes about 3 cm below the angle of the mandible Vertical incision extends from the middle of the horizontal beyond the clavicular insertion of the sternocleidomastoid muscle

infrequently Because metastases from the lip are usually limited to the upper part of the neck, sometimes in both submental and submandibular areas, a bilateral suprahyoid neck dissection may be performed. Because cancer of the floor of the mouth, tongue and tonsil tend to spread to the neck earlier, more frequently and more extensively than cancer of the lip, more neck dissections are necessary The complete unilateral (Fig 97) and occasionally a complete bilateral

neck dissection will be required There is no unanimity of opinion concerning the time of and the indications for neck dissection

It is not our purpose to discuss details of surgical treatment. It must be pointed out, however that improvement in preoperative, operative and postoperative care has permitted more radical surgical treatment.

DESTROY THE CANCER SAVE THE PATIENT

XXXIII

Radiation Treatment of Oral and Facial Cancer

IRRADIATION is the only accepted method besides surgery for the treatment of cancer The x-ray apparatus and radium (and radon) emit rays which are highly destructive of certain cells whereas other cells are resistant Consequently, tumors are frequently classified as radioresistant or radiosensitive Generally, the less differentiated the cell the more radiosensitive the tumor Conversely, the more differentiated the cell, the less radiosensitive it is This, then, is a determining factor in radiation treatment

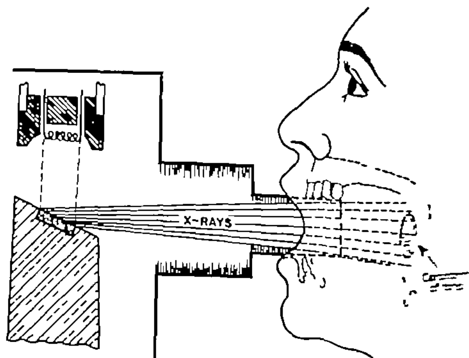
MODE OF ACTION

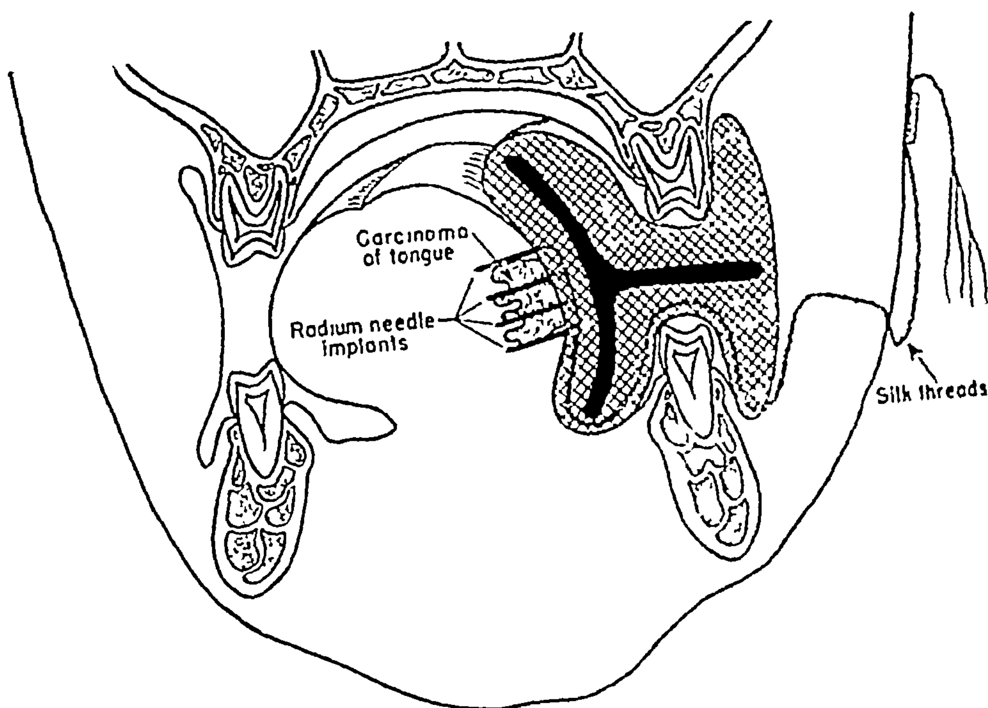
The process by which rays accomplish their destruction is not entirely known Actively dividing cells are more sensitive than resting cells The rays affect cell division in various ways. The cell may either stop dividing for a time and then recover and continue division or it may die and cease to exist The objective is to administer sufficient rays to stop division of the cancer cells without injuring the surrounding normal tissue Cells are most sensitive to the rays during mitosis Because not all cells are undergoing mitosis at the same time, several series of small doses of rays are given rather than one large dose In this way it is hoped to destroy all cells which are mitotically active at different times

ADMINISTRATION OF RADIATION

Radiation can be administered in three principal ways

1. *X-ray apparatus*—By this method the rays must travel from the machine through the air to the skin or mouth (Fig 98).


X-RAYS



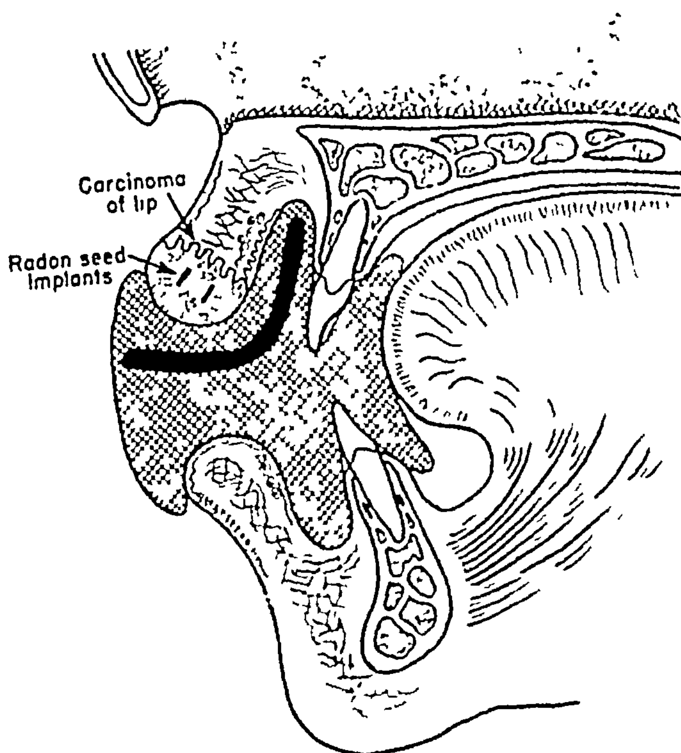


Fig 100—Diagrams of lead-impregnated prostheses (acrylic prostheses, cro hatched; lead shields, in black), designed to protect normal surrounding tis from radiation It is particularly important to shield the jaws and major saliv glands (Courtesy of Dr Roger A Harvey)

2. *Surface application of radium* —The radium is placed directly on the area involved. Frequently a Vulcanite mold is made to keep the radium in place in the mouth

3 *Interstitial application of radium or radon* —Radium needles or radon gold or platinum seeds are placed directly in the body of the tumor After the radium needles have been in place for the desired time they are removed The radon (gaseous emanation of radium) capsule or seeds are inserted by means of a hollow needle with a plunger and allowed to remain permanently (Fig 99) Within 30 days 99 5 per cent of the radon activity is lost.

It is frequently of great value to apply radium with a protective shield (Fig 100) This shield, usually made of lead, limits the spread of the radiation to adjoining soft tissues and particularly bone which are not to be irradiated (see pp 254 and 258 and Chap XXXVIII)

Radiation Reactions

The reactions to radiation are varied During the period of actual irradiation the patient is aware of no sensation. Two to three weeks later there may be some redness soreness and swelling of the skin and mucous membrane and a decrease in salivation (if salivary glands have been exposed) This usually subsides within a few weeks If the patient receives several treatments depending on the dose the skin may in a few weeks become blistered, edematous and painful. These are the expected reactions which will eventually subside. (See Chap XXXVIII for untoward reactions to radiation.)

ferred to a new site, they will maintain their original characteristics A hair-bearing free graft transferred to the mouth still bears hair and does not change to mucous membrane A flap taken from the abdominal wall maintains its original characteristics, and, when more fat is deposited in the abdominal wall, similarly it will be deposited in the transferred abdominal tissue

The source of these tissues is usually the patient himself (autog-

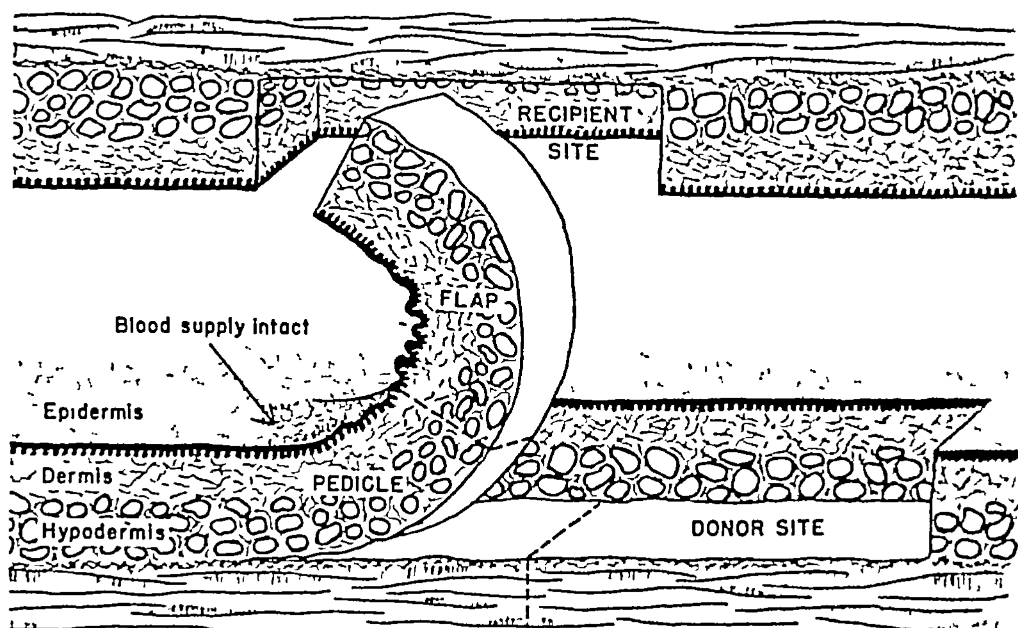


Fig 102 —Pedicle flap, supplying not only covering but filling material Blood supply is intact at the base, and the flap contains skin and also hypodermis and other tissues above the muscular fascia

enous) (Fig 101) Long experience has demonstrated that the patient tolerates best his own transferred tissues

Homotransplants —The challenge in plastic surgery today is how to utilize tissues of another human being either immediately or after storage in a tissue bank (Fig 101) It has been possible to do this with varying degrees of success with cornea, cartilage, blood (in blood transfusions) and, more recently, bone The success with both cornea and cartilage may be due to the fact that these tissues are avascular, have a low metabolic activity and have no blood supply of their own Transference in identical twins of free skin grafts has been successful Actually, these are autografts rather than homotransplants Thus as yet we are not able, with rare exceptions, 'to rob Peter to pay Paul"

Pedicle flaps.—A pedicle flap is utilized to transfer skin and subcutaneous tissue from one part of the body to another which is deficient in tissue. The flap which must have an adequate blood supply at all times obtains it through the pedicle (Fig 102) After an ade

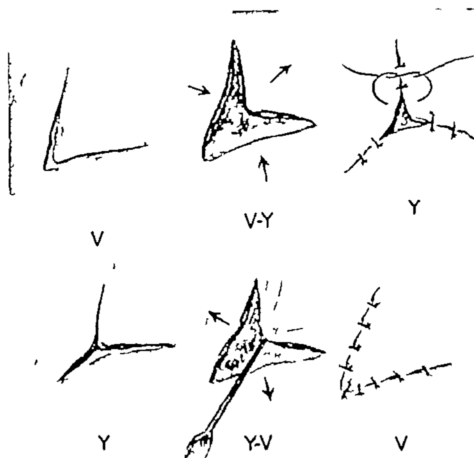


FIG. 103.—V and Y procedures which are concerned with the local direct shifting of flaps. The V Y procedure adds length, at the expense of width, to the wound. The V-shaped wound is closed in the form of a Y The Y V procedure adds width at the expense of length. The Y-shaped wound is closed in the form of a V (From Chapter on Oral-Plastic Surgery by B G Sarnat, in Epstein, E.: *Skin Surgery* [Philadelphia Lea & Febiger 1956])

quate blood supply has been developed between the flap and the site to which it has been transferred the pedicle is severed

TYPES.—There are many types of pedicle flaps. Those which have an adequate blood supply after being raised are transferred immediately These are known as immediate flaps and are exemplified in part by the V Y and Z procedures which are concerned with the local direct

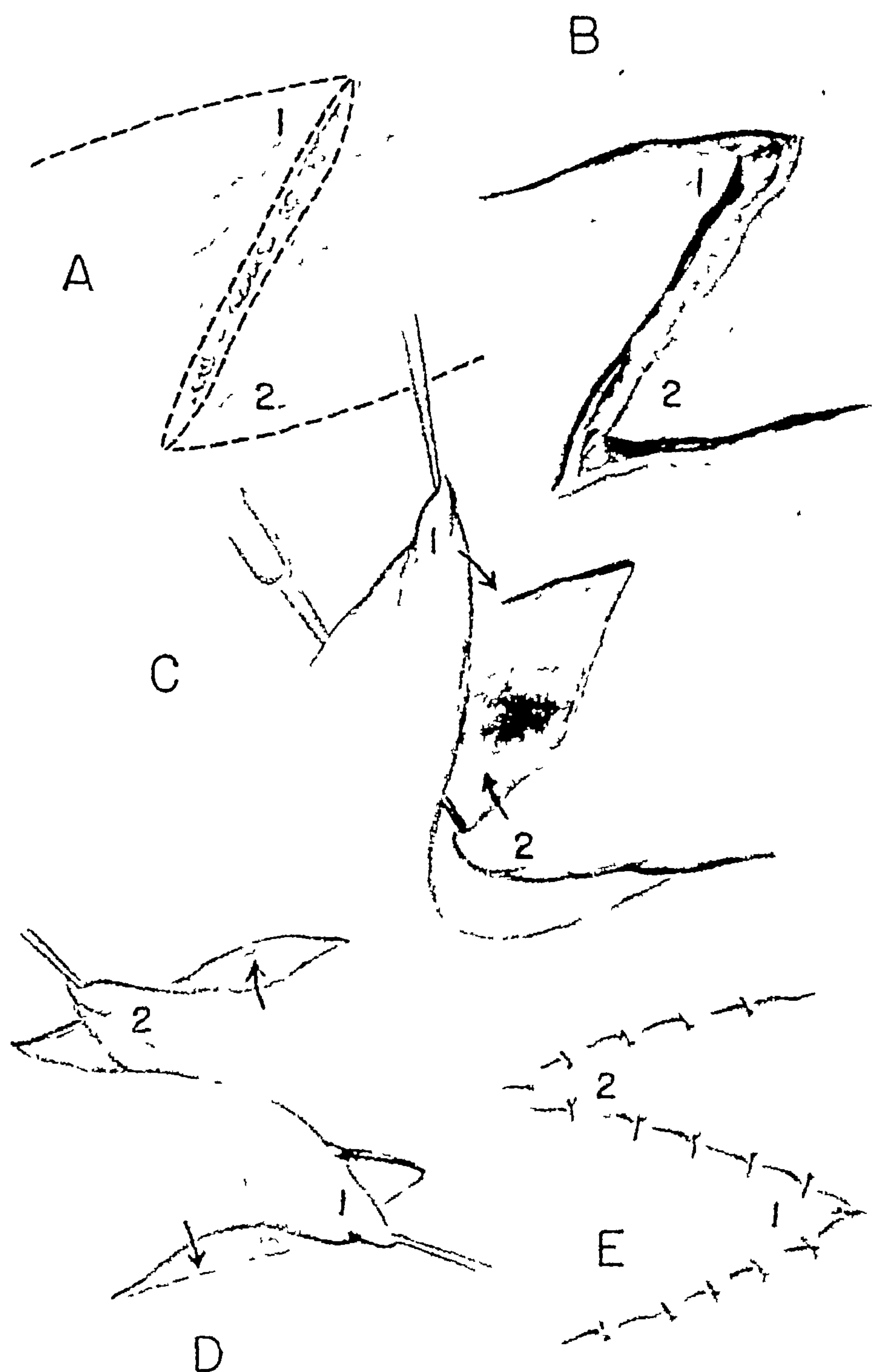


FIG. 101.—In the Z-plasty the incision is made in the form of the letter "Z" with the common boundary of the flaps connecting the two arms. The flaps are raised, transposed and sutured in the new position, thereby reversing the Z and changing the lines of tension. (From Chapter on Oral-Plastic Surgery, by B. G. Sarnat, in Epstein, E.: *Skin Surgery* [Philadelphia: Lea & Febiger, 1956].)

shifting of flaps (Figs. 103 and 104) If the blood supply is not adequate, the flap is sutured back into its original bed (Fig 105) and later raised again and transferred This is known as a delayed flap Sometimes after a flap has been raised along the lateral borders the borders are sutured together In this way the flap is completely covered by epithelium and there are no raw surfaces This is known as a tubed (or cylindrical) flap (Fig 106) A flap that is raised on the abdominal

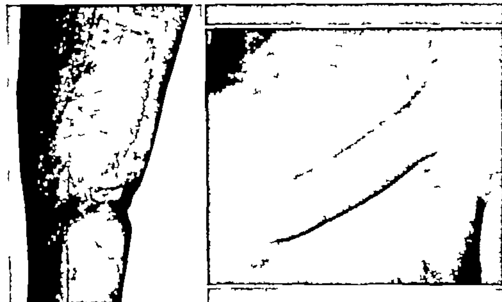


FIG. 105 (left) —Delayed flap. It was freed on three sides down to the muscular fascia and sutured back into its original bed. By this preparatory step a blood supply develops through the pedicle so that at the next stage the free end of the flap can be transferred to the desired site.

FIG. 106 (right) —Delayed tubed flap It is undermined down to the muscular fascia along the two lateral borders, which are then brought together and sutured inferiorly to create an epithelium-covered tubed flap Later the flap is cut free at one end and transferred to a new site.

wall and transferred by several stages to another region—the face, for instance—is known as a jump flap The arm can also be used as a carrier This indirect transfer of a flap is in contrast to the direct transfer wherein the tissue is directly implanted into the defect.

SOURCES.—Flaps can be raised almost anywhere on the body The extremities, abdominal wall neck and forehead are common sites The procedure is not new having first been described many centuries ago Only flaps from the patient can be utilized. Attempts to transfer flaps from one individual to another have consistently failed This procedure

might be successful if carried out in identical twins

ADVANTAGES AND DISADVANTAGES —A flap has skin as well as a thick subcutaneous layer (Fig 102) In addition, it has its own blood supply. The primary advantage of a flap is that it offers not only surface covering but also filling material for defects Furthermore, because of its independent blood supply, it can be applied to poorly vascularized and avascular areas such as tendon, bone and cartilage and tends to resist

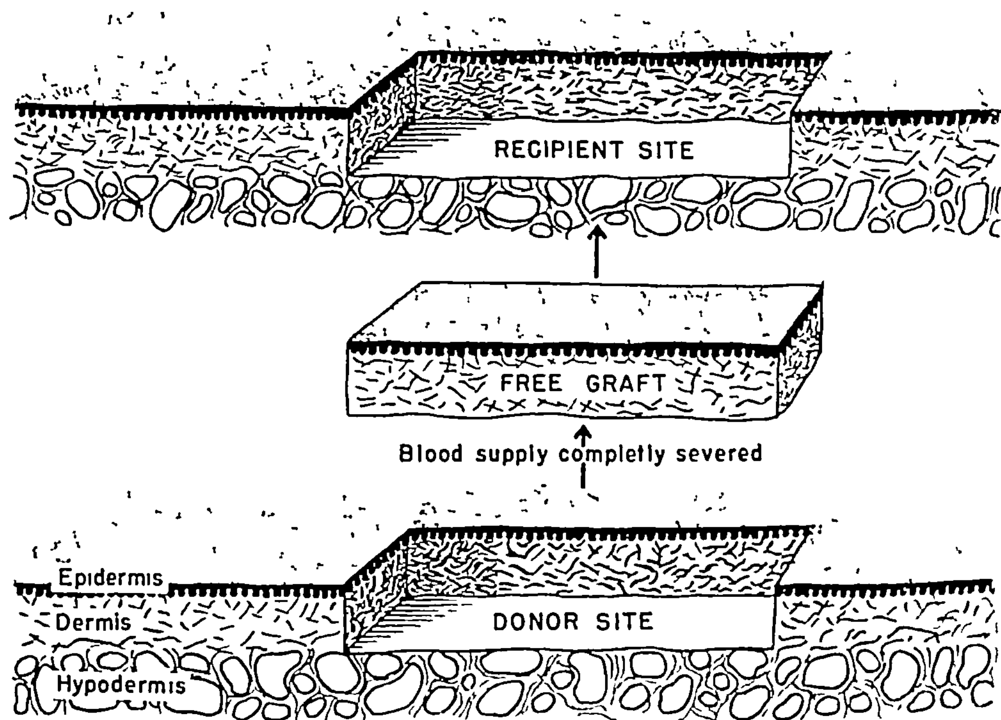


FIG 107 —Free graft Skin is the most frequently used material Epidermis and varying amounts of dermis are cut free and transferred to the new site

infection The disadvantages of pedicle flaps are the great number of operative procedures that are necessary, the prolonged hospital stay, the uncomfortable position which the patient may have to assume, the failures which may result and the deformity at the donor sites

Free grafts Types and sources—A free graft may be defined as tissue which is completely severed from its blood and tissue fluid supply and transferred to another part of the body where it must establish a new and independent blood and tissue fluid supply to maintain its viability permanently (Fig 107) There are many types of free grafts, each with particular characteristics and values A graft consisting of

one tissue, such as cartilage is known as a simple graft. Grafts composed of more than one tissue are called composite grafts. Immediate composite grafts of cartilage covered on two sides with skin have been successfully transplanted from the external ear and from the ala of the nose. Grafts may be classified according to the four primary tissues of

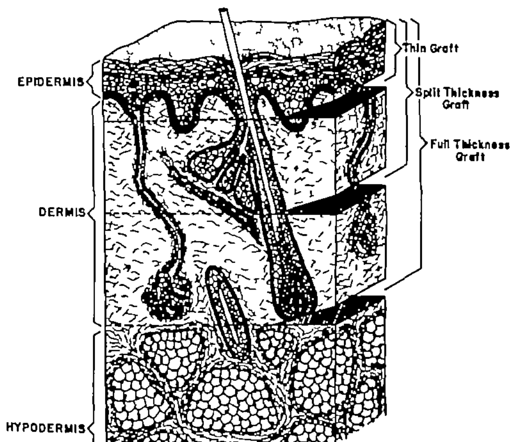


FIG. 106.—Skin grafts classified according to thickness. The thin graft includes epidermis and relatively little dermis The split thickness graft includes epidermis and varying amounts of dermis (usually at least one-half) The full thickness graft includes all of the epidermis and dermis.

the body—epithelium connective tissue, muscle and nerve. Those more commonly used are

1 Epithelium (and connective tissue)
  a) Skin
  b) Mucous membrane
  c) Cornea

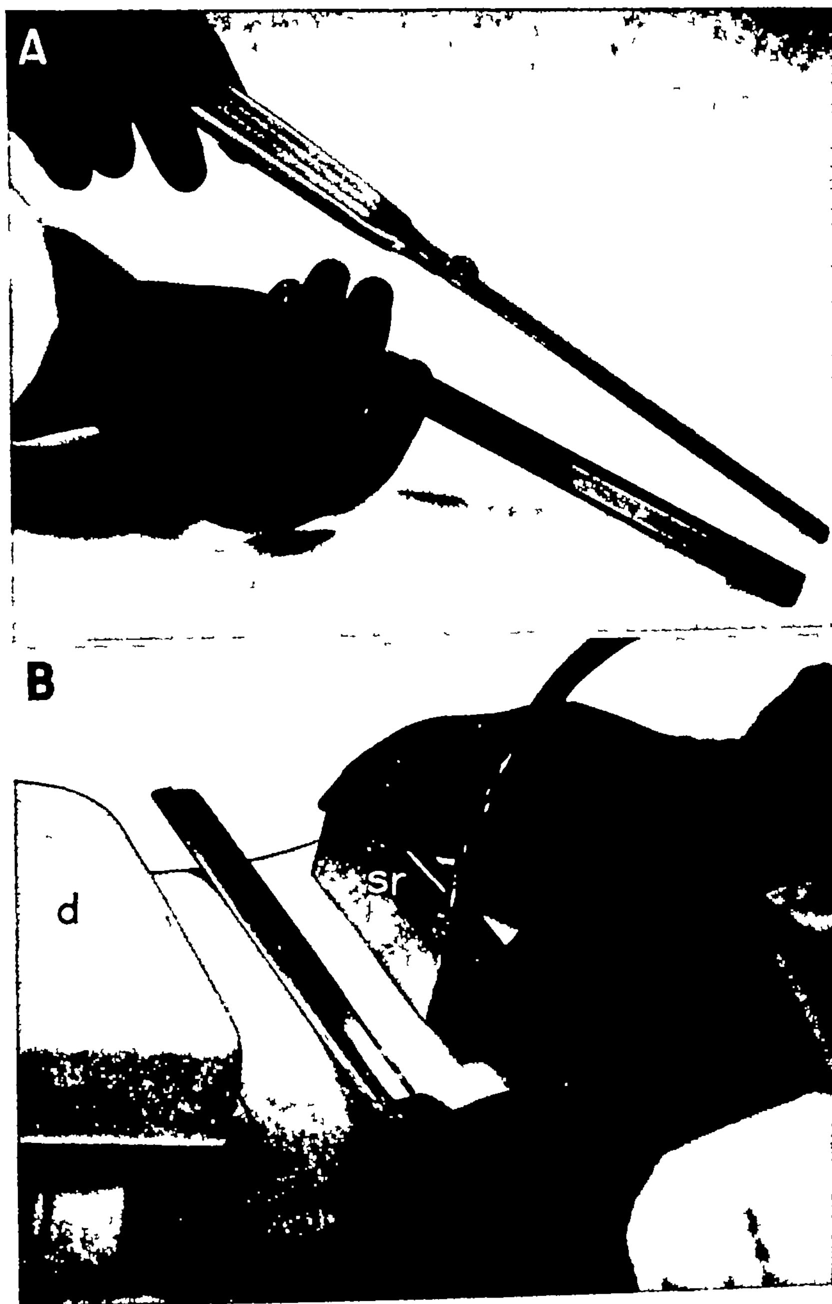


Fig 109 —Skin graft obtained freehand with knife *A*, knife handle before blade is inserted *B*, knife in position to cut graft *sr*, suction retractor, *d*, dish for counter-traction

2. Connective tissue
   a) Bone
   b) Cartilage
   c) Connective tissue proper
      1) Fascia
      2) Tendon
      3) Derma
      4) Fat
      5) Blood vessels
   d) Blood
3 Muscle
4. Nerve

SKIN GRAFT —Skin grafts are used primarily for covering or lining old or newly created raw surfaces Skin grafts may be classified accord

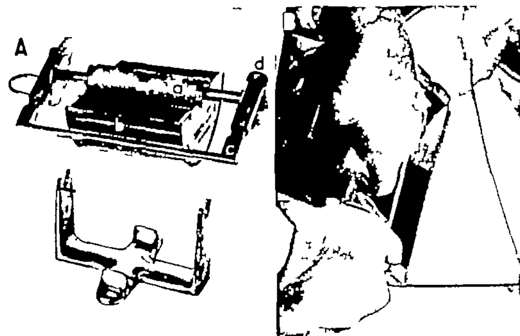


FIG. 110 —Padgett Hood dermatome A components of dermatome: a, handle b drum c, movable arm which contains blade d, screw to adjust distance of blade from drum to determine thickness of graft. Below stand for dermatome when not in use. B position of dermatome before cutting of graft. Rubber cement has been placed on both drum and skin so that the two surfaces cohere. The movable arm (anteroposterior and also lateral) with attached blade is then brought down and cuts the skin attached to the drum. A graft 4 × 8 in. can be obtained

ing to thickness, size method of procurement and source. They may vary in thickness from about 0.2 mm (thin) which includes epidermis and relatively little dermis, to about 1 0 mm. which includes all of the

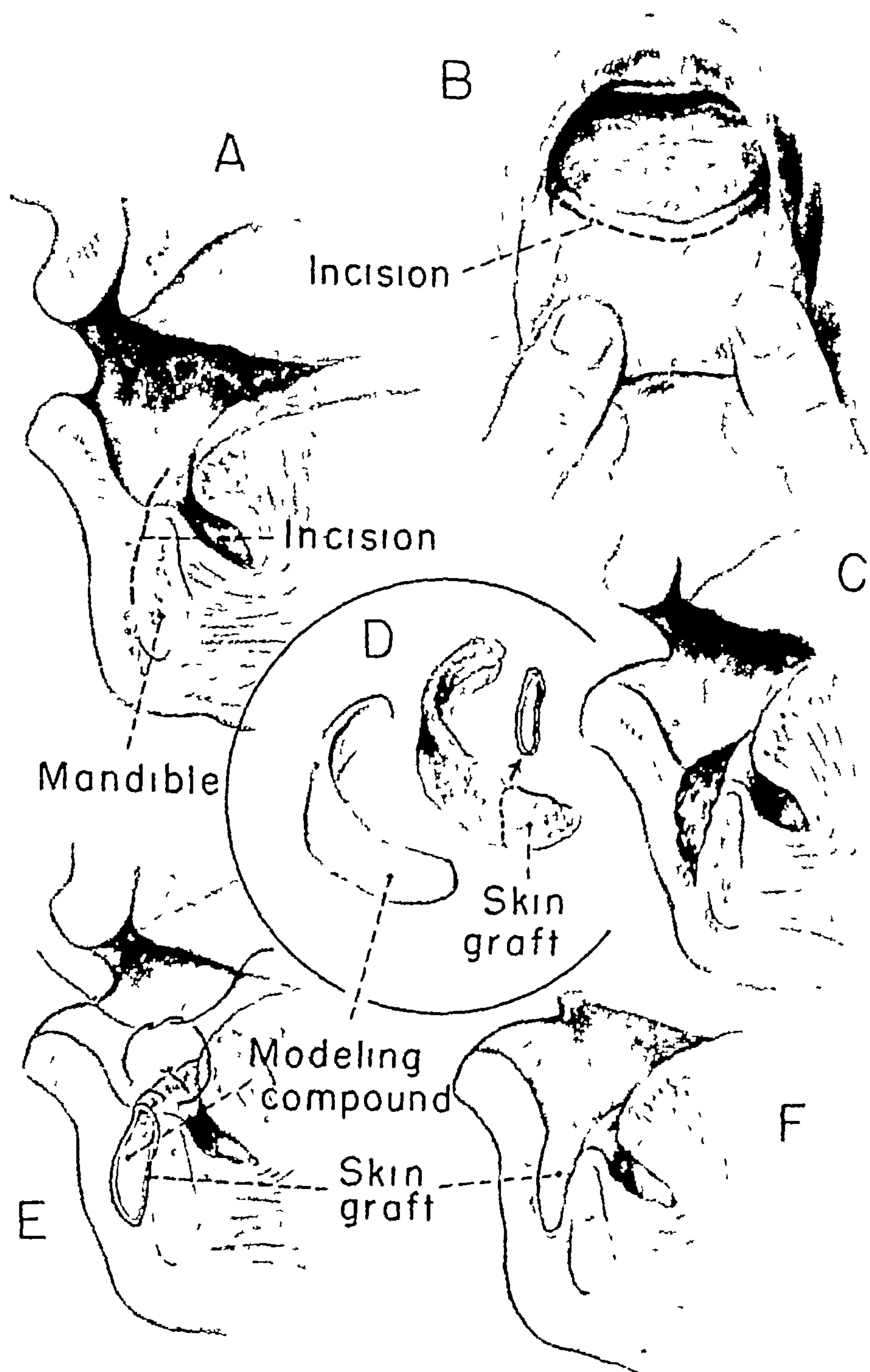


FIG 111 —Use of skin graft to deepen gingival labiobuccal sulcus *A*, lateral view Line of incision in region of deficient gingival labiobuccal sulcus *B*, front view *C*, sulcus created with raw surfaces on gingival and on labiobuccal sides *D*, modeling-compound impression of newly created sulcus with skin graft wrapped around it *E*, modeling-compound impression and skin graft (with raw surface outward) inserted into newly created sulcus Note that the gingival and labiobuccal surfaces had been approximated with sutures, thereby fixing the graft and modeling-compound impression in position *F*, newly created gingival labiobuccal sulcus lined with skin graft

epidermis and dermis (full thickness) but no hypodermis (Fig 108) The thick graft contracts less and is better for covering, but it is more difficult to obtain a "take" than with a thinner graft. Usually one piece of skin large enough to cover the defect is used. It can be obtained by means of a knife (Fig 109) by use of a dermatome (Padgett Hood) (Fig 110) or by other special mechanical devices for obtaining skin grafts

Cancer of the skin is frequently excised and the bare area covered by a free skin graft. Flaps to be placed over cavities (cheek, maxillary

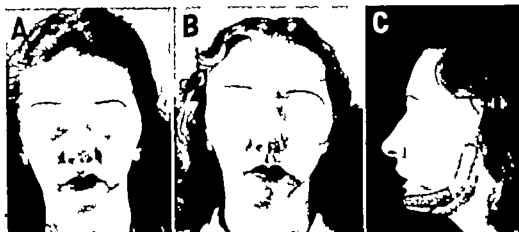


FIG. 112.—*A* preoperative and *B* and *C* postoperative views of patient who had lost the entire left side of the mandible. Bony and cartilaginous portions of a rib were used. The bony portion was attached to the remaining mandible and the cartilaginous portion inserted into the region of temporomandibular fossa. In *B* note increased fulness of left side of the face In *C* the dotted line indicates position of the graft, stippled area, the bony portion clear area, the cartilaginous portion. (From Byars L. T and Sarnat, B G Surg., Gynec. & Obst. 81 575 1945)

sinus) must be lined with epithelium by means of either a skin graft or a flap Skin grafts are also used to line a newly created and deepened buccal sulcus (Fig 111) Since a thinner graft tolerates infection better it is used in the mouth in preference to a full thickness graft. Because skin grafts maintain their original characteristics they should be taken from areas which are relatively free of hair Hair growing areas in the mouth are annoying to the patient. Mucous membrane grafts are not used a great deal because of the limits of the amount of available tissue and the greater difficulty in obtaining a satisfactory graft.

CARTILAGE.—This is usually obtained from a rib (costal cartilage) sometimes from the ear or nose, and serves as a filling and supporting

material It is frequently used to build up deficient areas such as underdeveloped mandibles or where substance has been lost (Fig 101, p 235) Sometimes a portion of rib which contains both cartilage and bone is taken to replace a missing part of the mandible which includes the condyle The cartilaginous portion is inserted in the region of the temporomandibular fossa and the bony part fixed to the remaining portion of the mandible (Figs 112 and 113)

BONE —Bone grafts are frequently used to correct deficiencies of the mandible after the removal of tumors Wherever a resection is done, some provision must be made to maintain the remaining fragments of the mandible in as nearly proper position as possible before bone graft repair (Table 12) If there has been disarticulation in removal of the

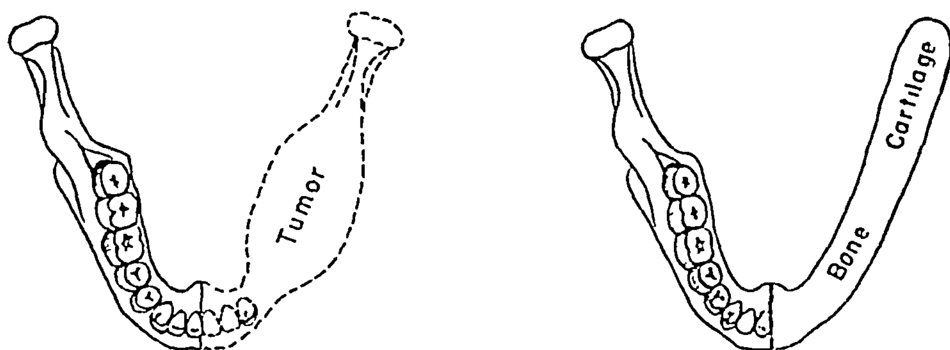


Fig 113 —Hemisection of the mandible because of a tumor and reconstruction by use of a bone-cartilage rib graft (see Fig 112)

ramus, only the anterior fragment must be considered In this case the simplest and best method of maintaining position is to wire the remaining teeth in occlusion until the soft tissue is completely healed. This same procedure may also be the simplest when there are teeth on both the anterior and the posterior fragment However, if the resection has been near the angle of the jaw so that the angle and ramus remain as the posterior segment, some means must be found to maintain not only the space between fragments but also the posterior fragment in its proper position (Fig 114) Various methods have been used to control the posterior fragment (Table 12) It is essential that this space retention be maintained until there is complete soft tissue healing Otherwise, as soft tissue healing occurs there will be progressive dislocation of the fragments by the pull of the various muscles and the newly forming scar tissue This dislocation will interfere with later repair by bone graft Dislocation by scarring is especially common

where the mucosa has been removed and a granulating wound has been left inside the mouth to heal by secondary intention

Many patients apparently are content to continue without having the defect in the mandible repaired. Some have been able to wear den-

TABLE 12.—APPLIANCES TO CONTROL FRAGMENTS OF MANDIBLE AFTER RESECTION

A. APPLIANCES USING TEETH (INTRAORAL)
(POSTERIOR FRAGMENT CONTAINS TEETH)

†a) Interdental wires.
†b) Arch bars.
†c) Swaged metal splint (with or without jack screw)
d) Splint on teeth with dependent part separating bone

B. APPLIANCES USING BONE AND TEETH (INTRA AND EXTRAORAL)
(SHORT EDENTULOUS POSTERIOR FRAGMENT)

†a) Wire teeth in occlusion. Use modeling compound in molar area to keep posterior fragment down.
†b) Arch bar or splint with posterior fork to keep posterior fragment down.
†c) Arch bar or splint on mandible with posterior portion accurately fitted to junction of body and anterior border of ramus (Herpin splint with or without jack-screw)
†d) As in (c) except arch bar or splint applied to maxilla with interdental wiring.
e) Arch bar or splint with posterior part attached
   1 Directly to bone
   2. To bone screw
f) Pass wire through drill hole near angle of mandible and attach posteriorly to head cap. Wire rest of jaw in occlusion.

C. APPLIANCES USING BONE (INTRA AND EXTRAORAL)
(NO. OF TEETH AND SIZE OF POSTERIOR FRAGMENT
NOT NECESSARILY A CONSIDERATION)

‡a) Extraoral bone screws (and bar) inserted into each fragment. (Stader Berry Griffin, etc.)
b) Kirschner wires (modified) passed through fragments.
c) Bar passed through *drill holes in end of each fragment.*
†d) Open bite splint attached with circumferential wires.

Modified after Byars, L. T., and Sarnat, B G Surg., Gynec. & Obst. 81 575-584 November 1945

†Also controls fragments adequately for insertion of bone graft.

‡Not ideal for bone graft because of local osteomyelitis around bone screws and subsequent loss of stability of splint.

tures. Unquestionably the patient is more comfortable and his situation is more normal if a repair of the resected area of the mandible can be obtained with bony union. A number of methods may be employed, but in general the use of a free bone graft is the most desirable procedure.

To carry out the procedure of a free bone graft satisfactorily certain

conditions have to be met The remaining fragments of the mandible must be freely movable so that the proper position can be obtained and maintained while the bone graft is healing (Fig. 114, *B*). It is extremely important that the covering soft tissue be adequate in quality and amount to give good covering and nourishment to a bone graft If the overlying tissue has been damaged to the point where it is scarred and tight, the graft is likely to be extruded This is well illustrated in one patient (Fig 115) who had lost two bone grafts because they were placed in dense scar tissue If it is necessary to dissect dense scar tissue from between the ends of the bone before they can be re-

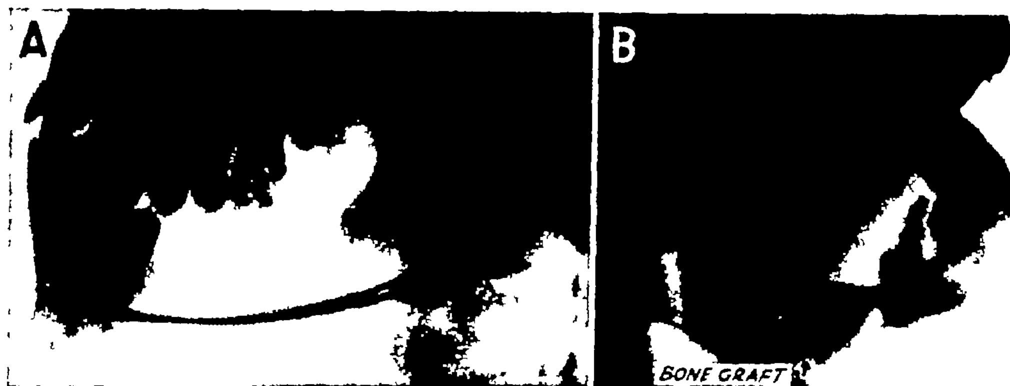


Fig 114 —*A*, lateral roentgenogram after subperiosteal resection in which position of mandibular fragments was maintained by stainless steel bar inserted (before placing of bone graft) through drill holes in the bone *B*, lateral roentgenogram after resection, stabilization of fragments and insertion of bone graft The opposite side of the jaw was wired in occlusion and an attached splint holds the posterior fragment in position (From Byars, L T, and Sarnat, B G Surg, Gynec & Obst 81 575, 1945)

stored to their proper position, this must be done before insertion of the bone graft to prevent contamination from the oral cavity. In certain instances it may even be necessary to apply additional soft tissue by means of flaps (Fig 115) either to replace scar tissue or to supplement inadequate covering material which is present This is done before insertion of the bone graft

The bone graft may be massive, using the half or full thickness of the rib or a section of the iliac crest, or it may be thin, as in the case of an osteoperiosteal graft taken from the tibia Regardless of the type of graft used, it is desirable to overlay the ends of the mandible with an inch or so of the bone graft where possible, thus making the bone graft 2 in longer than the defect In some instances the portion of the graft which overlaps the ends of the mandible may be thin while the portion between the ends is thicker. Sometimes a T-shaped graft may

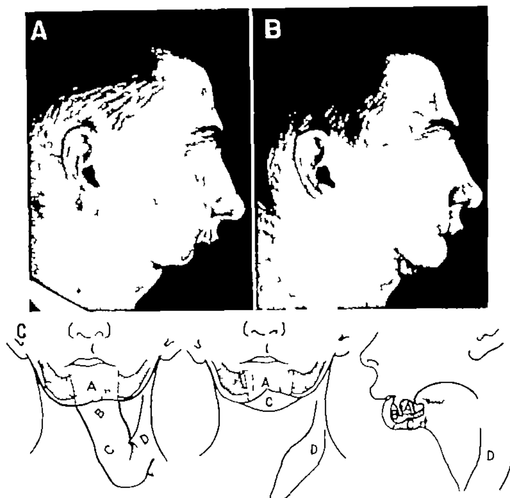


FIG. 115 —*A*, preoperative and *B* postoperative views of patient who had lost the mandible from bicuspid to bicuspid area and soft tissue. Scar tissue binding anterior mandibular fragments was released and a neck-chest flap inserted to give added soft tissue. The same flap was used to line the buccal sulcus and cover the lower part of the chin. A bone graft was inserted later *C* diagram of source and use of flap tissue in *B* (From Byars, L. T and Sarnat, B G Surg. Gynec. & Obst. 81 575 1945)

be employed, the thick arm of the T projecting between the ends of the mandible In all instances the bone graft should be in as close contact with the mandible as possible and anchored to soft tissues or even to the bone itself with silk or fine tantalum wire sutures

FASCIA.—The fascia lata on the lateral aspect of the thigh has high tensile qualities It is, consequently used to support the facial tissues on the affected side in facial nerve paralysis Fascial strips are inserted subcutaneously and attached near the corner of the mouth and the mid

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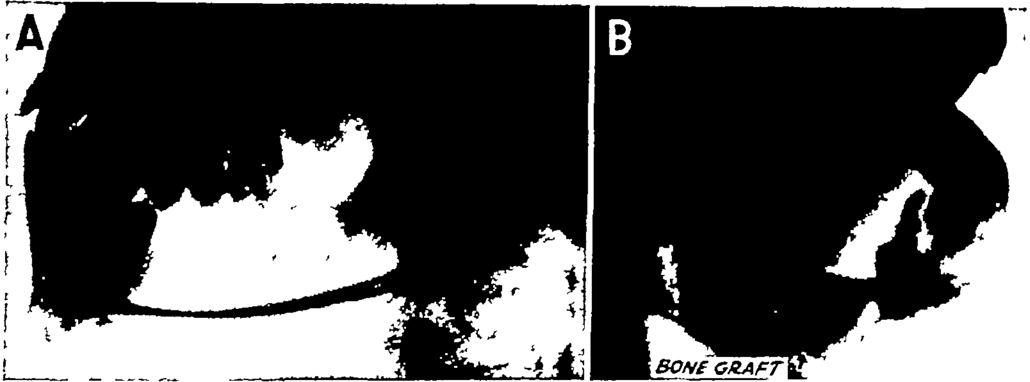


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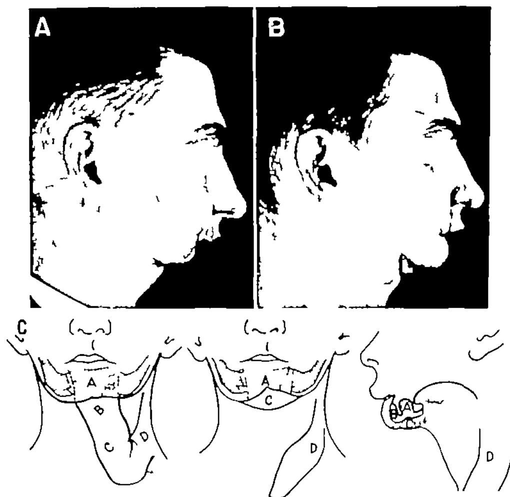


FIG. 115—*A*, preoperative, and *B* postoperative views of patient who had lost the mandible from bicuspid to bicuspid area and soft tissue. Scar tissue binding anterior mandibular fragments was released and a neck-chest flap inserted to give added soft tissue. The same flap was used to line the buccal sulcus and cover the lower part of the chin. A bone graft was inserted later *C* diagram of source and use of flap tissue in *B* (From Byars, L. T., and Sarnat, B G Surg., Gynec. & Obst. 81 575 1945)

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line of the upper and lower lip The other ends of the
tached to the temporal fascia and muscle and tighten

OTHER SOURCES—Mucous membrane, cornea, ten
nerve, muscle, teeth and kidney are other tissues a
have been transplanted The reader is referred to te
surgery for further details (14, 28).

ADVANTAGES AND LIMITATIONS.—Grafts are obtained
in one surgical procedure. Sometimes if more graft
ondary procedure is carried out Consequently, long
not as necessary as when pedicle flaps are employed
cannot be transferred to avascular areas, they can
well prepared beds. They do not tolerate even slight
as flaps and do not always supply the necessary amou
in quantity or in quality

ALLOPLASTIC MATERIALS

Nonhuman materials used as transplants are known
terials. Because of the difficulty frequently encounte
human tissue, alloplastic material has been utilized

Types—Occasionally transplants from another sp
(heterotransplants) have been attempted (Fig 101,
bone, cartilage, ivory and glands are some of the su
Among the nonvital materials, paraffin, celluloid and
plastics have been used Sarcomas have been produce
by subcutaneous implantation of the last mentioned
Certain inert metals, such as Vitallium and tantalum,
tively satisfactory As each new material is reported, i
undue enthusiasm and insufficient evaluation. None h
successful and has withstood the test of time. Autogen
the best

Advantages and disadvantages—There would be de
in the use of alloplastic materials Being always availa
be no limitation as to quantity and the material could
the correct shape preoperatively This would save the
al operative procedures and shorten the operating ti
The disadvantages are that few of these materials a
human tissues, particularly if the overlying tissue is sub
or motion A foreign body reaction and infection may

XXXV

Prosthetic Reconstruction

Indications and contraindications—Replacement of destroyed portions of the face and mouth after treatment for cancer is frequently important so that the patient can continue without embarrassment as a member of society If the replacement cannot be accomplished by the transference of human tissue (plastic and reconstructive surgery) the development and application of an appliance made of artificial material (prosthesis) is indicated In certain conditions it is advantageous to make use of the latter method. Prosthetic appliances are used primarily (1) on a temporary basis between the period of production of the deformity and surgical correction and (2) on a permanent basis when the age, health (general and local) and inclination of the patient do not warrant surgical correction The objections to prosthetic appliances are that they must be applied and removed at frequent intervals because they may cause irritation of the tissues become unclean or loose. For these reasons and others some patients who initially preferred a prosthetic appliance subsequently seek surgical correction of the deformity

Desirable properties of ideal material—Materials used in the construction of oral and facial prostheses should meet the following requirements

1 Compatible with the surrounding tissues
2. Readily plastic
3 Light in weight
4. Translucent, yet not transparent
5 Easily moldable and subject to little change in volume during processing
6 Poorly conductive of heat and cold
7 Chemically and physically unaffected by sun, heat, cold, oils, exogenous pigments

8 Washable
9 Easily duplicated
10 Inexpensive
11 Not too smooth a surface texture
12 Not inflammable
13 Relatively unbreakable and permanent

Materials used—Various materials such as metals, Vulcanite and celluloid formerly were used Although they were durable, they lacked the texture and translucency of the tissues The restoration had a hard, rigid appearance The use of prevulcanized liquid latex was an advance over previous methods, but a serious disadvantage was the shrinkage of the material Hard acrylic resins which were used for dentures were next utilized These too were not entirely satisfactory More recently a material was developed which meets nearly all of the requirements This material is a resilient (polyvinyl) resin

The implanting of methyl methacrylate in the abdominal wall of mice has produced a significant incidence of sarcomas (75) One should, therefore, be cautious in the subcutaneous use of this material and other plastics in the construction of prostheses.

Methods—The essential steps in the construction of any oral or facial prosthesis are (1) Obtain an accurate impression of the involved area (2) Develop a model from the impression (3) Construct a prosthesis from the model (4) Apply the prosthesis to the involved area The reader is referred to textbooks which discuss in detail the materials and methods employed in the processing of oral and facial prostheses (5, 8, 36)

PROSTHESES

Restorative prostheses—Individuals who need either oral or facial prostheses are found in every community This is because no vital tissue of the body is immune to cancer and because in the surgical and/or radiation treatment tissue is destroyed Replacement of the hard or soft palate (Fig 116), the maxilla or mandible, the chin, lips, cheek, nose (Fig 117) or ear, in part or in whole, is frequently required Sometimes the area must be prepared surgically for the reception of a prosthesis

As in the case of reconstructive surgery, it is usually easier to make a reconstruction of the entire part than a partial one to supply only the missing part A better result can be obtained in regard to retention and matching when a complete ear or nose is made rather than a par-

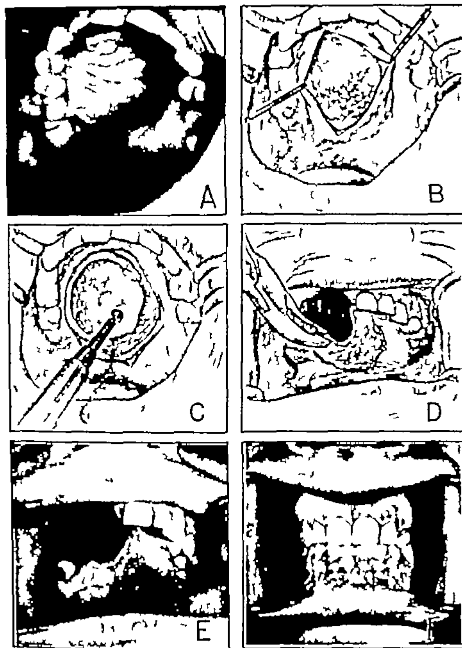


FIG. 116.—Benign giant cell tumor of hard palate in an 11 year old boy. The diagnosis was confirmed by microscopic examination of a biopsy specimen. *A*, photograph of palatal region. *B* exposure of tumor mass by reflection of the tissue flaps. *C* the bulk of the tumor mass which was quite friable, has been removed by means of scalpel and curettes. That which remains is being destroyed by means of electrocautery. *D* the hard palate had been invaded and partly destroyed by the tumor mass. The remaining bone is being removed by means of a rongeur. A communication has been established between the oral and nasal cavities. Because the tumor mass had invaded the alveolar bone, all the teeth and alveolar bone in that quadrant were removed except the unerupted third molar. *E* oral condition of patient one month after local removal of the benign giant cell tumor. *F* prosthesis in place. (From chapter on Oral-Plastic Surgery by B. G. Sarnat, in Epstein E.: *Skin Surgery* [Philadelphia: Lea & Febiger 1956].)

tial one The ideal prosthesis should meet the following requirements

1 It must be esthetically pleasing
2 It must not be noticeable even at close range
3 It must be comfortable
4 It should improve function
5 It should be hygienic and capable of being readily cleaned
6 It should be self-retentive when possible If this is not possible, the mechanical or adhesive means should be simple and neat

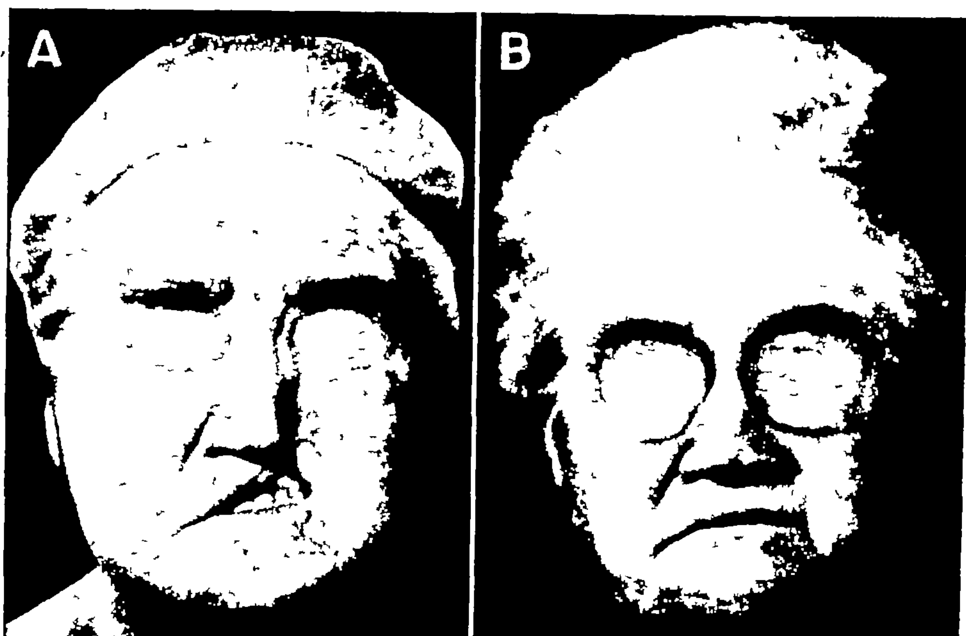


FIG 117 —*A*, deformity of nose, cheek and lip as result of surgical treatment of carcinoma *B*, prosthesis in place (photograph is not retouched) (Courtesy of Dr Stanley D Tylman)

Protective prostheses —In addition to the restoration of esthetics and function, prostheses serve another important function, that is, as a protective shield from radiation (Fig 100, p 232) For instance, if the radiotherapist plans to irradiate a cancer in a particular region, it is important to protect surrounding areas which are not under treatment This applies particularly to intraoral lesions, where it is difficult to protect adjacent areas, especially bones

The construction of such appliances is neither difficult nor expensive The dentist, by training, is well equipped to render such service to the radiotherapist. Dental modeling compound can be used, but it tends to soften and become distorted Vulcanite and the hard acrylic resins

can also be used in conjunction with lead strips A plastic material containing 90 per cent lead powder has been utilized in facial masks to protect the skin. More recently a lead impregnated shield made of resilient resin has been employed intraorally In addition to protecting the surrounding area, the accurate fit of the prosthesis will maintain the radium in the proper position.

REHABILITATE THE DEFORMED PATIENT

XXXVI

Role of the Dentist in Care of the Cancer Patient

ORAL HYGIENE is both an important factor in the care of the cancer patient and an important means of possible prevention of cancer The dentist has the responsibility of either preventing or removing every source of chronic irritation in the mouth.

The following preventive measures are therefore part of the daily routine treatment of every patient These measures were outlined by the Council on Dental Health of the Dental Society of the State of New York

1 Correct badly decayed teeth, particularly projecting, jagged edges
2 Treat "pyorrhea" to remove chronic foci of infection and the irritating influence of mobile teeth
3 Prevent and correct early malocclusions which present irritating irregularities in the dentition
4 Replace missing teeth early to preclude shifts in position of the remaining teeth which, in turn, produce malocclusions and areas subject to impaction of food
5 Correct or eliminate faulty dental restorations which are sources of irritation
6 Discourage continued use of escharotics in treatment of soft tissue lesions
7 Discourage excessive use of tobacco
8 Discourage occupational habits involving chronic irritation, e g, the cobbler's and upholsterer's habit of using the mouth as a reservoir for nails
9 Discourage continued use of all irritating mouth washes and dentifrices.
10 Caution against overexposure to the actinic rays of the sun and sun lamps to eliminate the possibility of lip and skin cancer
11 Encourage early detection and treatment of syphilis

In a cancer program the dentist has not discharged his duty after he has taken a history made a complete oral examination, arrived at a diagnosis and referred the patient to the specialist who will treat the cancer The dentist has also direct responsibilities in the oral care of the patient who is receiving treatment for cancer The specialist depends on the dentist to place the mouth in the best possible functional condition. This insures adequate nutritional intake and avoids local aggravation of the lesion.

Oral Hygiene

Oral hygiene should be maintained in all mouths This is especially important in the patient with oral cancer where oral hygiene is usually neglected or at a low level. The oral neglect may be a result of pain infection, trismus and the patient's general attitude With proper oral hygiene the infection, pain and bad breath can be combated and the emotional health of the patient improved.

Dental Restorations

All teeth which are to be retained should be restored. No rough or jagged teeth, poor margins of fillings or crowns, ill fitting clasps or dentures should be allowed to remain.

Dental Extractions

After a complete clinical examination of the teeth and supporting structures and study of the roentgenograms, all teeth which have advanced caries, unusual resorption of alveolar bone or periapical involvement should be extracted. Teeth which will be exposed to radiation should be extracted regardless of their condition (Figs. 100 p 232, and 119 p 266) All questionable teeth, root fragments and infection should be removed. Dental extractions should be treated as an emergency because they must precede radiation therapy which can be started within seven to 10 days after extraction. However no teeth should be removed without consulting the specialist in charge In selected instances, teeth which are loosened by the surrounding tumor should be removed by the surgeon at the time he treats the cancer Their removal before surgical treatment may only lead to spread of the cancer The radiotherapist may want certain teeth removed in and

adjacent to the area to be radiated Isolated teeth which may be healthy but will not be functional should be removed

Thus, by improving oral hygiene, by providing the dentition with proper restorations, by removing infection and by extracting functionless teeth, the dentist can make a significant contribution toward strengthening the patient's pretreatment condition The possibilities of a better result with decreased risks are enhanced. Furthermore, the patient will have a less stormy post-treatment period

Pre- and Postirradiation Care

The oral cavity should be in the best possible state of health before radiation therapy However, this care must be rendered in minimal time because the radiotherapist has to treat the cancer as quickly as possible The teeth should be cleaned and restored Teeth which require extensive and time-consuming dental operations and teeth which are pulpless or have periapical infection should be extracted The gingiva should be in good health If gingivitis and periodontitis are advanced, the tooth should be removed before radiation therapy Occasionally, when radiation is to be given in a large dose or over an extensive area, it may be advisable to extract all teeth

The dentist is frequently called on by the radiotherapist to make a mold which will contain and maintain the radium needles in the desired place Modeling compound or other dental materials are frequently used Because of the dentist's experience in working with these materials and his special knowledge of the oral cavity, he can be of great aid to the radiotherapist In addition, the radiotherapist may want to protect the noncancerous area against the effects of radiation The dentist may be called on to construct a shield which will confine the rays to the desired site (Fig 100, p 232).

The mouth frequently becomes quite tender after radiation therapy. Consequently, the patient will tend to neglect his oral hygiene and it will become the dentist's responsibility to help keep the mouth clean In addition, the patient may not be able to wear an artificial denture because of swelling and tenderness When the reaction has subsided and the artificial denture does not cause any discomfort, he may resume its use However, the denture may have to be modified to fit properly because of the change in size and contour of the irradiated areas

Pre and Postsurgical Care

The oral cavity should be in the best possible state of health and cleanliness previous to surgical treatment. This precaution will also materially reduce the anesthetic risk because of the decreased possi bility of aspirating oral material. If a portion of the mandible is to be removed in the surgical procedure, the dentist will probably be called on to construct a dental splint which will temporarily maintain the mandibular fragments in position (Fig 114, *B* p 248 and Table 12, p 247)

Deformities of the face are not uncommon after removal or destruc tion of the carcinoma. These deformities require correction so that the patient may continue without undue embarrassment as a member of society The dentist with proper additional training soon qualifies to make adequate intra and extraoral prostheses (Figs. 116 and 117 pp 253 and 254)

THE DENTIST PLAYS AN IMPORTANT ROLE IN THE CARE OF THE PATIENT WITH ORAL CANCER

XXXVII

Complications Related to Cancer and Surgical Treatment

Complications Related to Untreated Cancer

Continued growth of the tumor and death.—If left unchecked, cancer will continue to grow at the expense of the host and eventually cause death. The rate of tumor growth will vary with the type of tumor and the age and health of the individual. There are two types of facial skin cancer that differ considerably in their rate of growth. The malignant melanoma, a black, deeply pigmented tumor, grows and spreads rapidly to distant sources, with death sometimes resulting in a matter of weeks. The second type is the basal cell carcinoma, which grows slowly, seldom metastasizes and will probably not cause death for years. Generally, the younger and the better nourished the patient the more rapidly the tumor will grow.

With continued uncontrolled cellular proliferation and increased size of the cancer, more and more demands are made on the patient's body economy to supply nourishment. If the growth is so located as to interfere with adequate food intake, the patient, not the cancer, will show signs of malnutrition. With decreased food intake the patient's health begins to fail, he becomes cachectic and shows a decreased resistance to infection. While bedridden, he may die of complicating pneumonia. The cancer may also cause death either by interfering with some important function or by obstructing some vital passageway.

Sometimes the tumor outgrows its blood supply. Parts of it will then undergo necrosis and become secondarily infected, causing the patient to become toxic. A blood vessel wall may be eroded by the tumor in the area of necrosis. If the blood vessel is of major size, a fatal hemorrhage may ensue.

"Spontaneous cure"—Occasionally one hears of a spontaneous cure of cancer or of a cure by cultists or quacks In such instances it is important to verify the diagnosis This is rarely possible if the patient is healthy at the time of examination because the alleged "cancer" cannot be examined any more. It is true however that on rare occasions a histologic diagnosis of cancer is not borne out by the subsequent clinical course In addition, different pathologists sometimes give conflicting reports after examining the same tissue Sometimes a reduction of the tumor occurs if the cancer outgrows its blood supply if the blood supply is decreased for some reason or if there is for unknown reasons a temporary remission in the progress of the disease This should not be construed in any way as a cure

Today there are only two accepted methods for the treatment of true cancer (1) surgery and (2) irradiation If cancer is not treated in either of these ways death will eventually ensue Remissions may occur but they are usually temporary

Complications Related to Surgical Treatment

Death deformity dysfunction—Death may result from the surgical treatment of cancer However the risks are considerably better today than they were 50 years ago because of the improvements in preoperative, operative and postoperative care Certain types of oral cancer (tongue, jaw) require more radical surgery than others, with a resulting higher mortality Nevertheless surgical treatment will be undertaken, even when the risks are high since there is no other hope for the patient.

Because surgical treatment requires either complete destruction or removal of the growth the end result frequently is a deformity If this is in the face, correction is usually necessary Treatment of cancer of the mouth sometimes requires removal of portions of the mandible or maxilla, tongue lip cheek or palate. Dysfunction usually results. Injury to the facial nerve and paralysis of the facial muscles usually result from surgical treatment of cancer of the parotid gland. Destruction of the buccal mucosa may lead to scarring and subsequent contracture of the cheek tissues and inability to open the mouth However considerable deformity can be prevented by the preparation of splints and prostheses to be utilized when surgery is carried out.

Persistence or "recurrence" of tumor—Many of the cases of so-called cancer recurrence have resulted from incomplete surgical removal. If

the cancer *is* not completely removed initially, subsequent follow-up treatment is necessarily late and usually not satisfactory The cancer really does not recur it had not been completely removed Subsequent operations usually have to be more radical and the possibility of complete removal is considerably lessened Unfortunately, in the surgical removal of cancer we must depend on clinical judgment to guide us For certain selected cancers of the skin, careful microscopic study of serial sections of the removed tissue will determine not only whether all of the cancer has been removed but also, if not completely removed, the site where it remains Chemosurgery, which is slow, tedious and time-consuming, is neither practical nor applicable for other types of carcinoma.

At no time can one be absolutely certain of a cure. Consequently, once a patient has been operated on for cancer, he must be examined at regular intervals Patients who have had one cancer are more likely to develop a second one Since cancer formation may be multicentric, other areas may undergo malignant change.

INCOMPLETE SURGICAL REMOVAL OF CANCER DOOMS THE PATIENT

XXXVIII

Complications Related to Radiation Treatment

USUALLY THE cancer victim prefers radiation to surgical treatment. This is frequently based on the belief that radiation treatment is not painful, will not produce deformity and does not entail anesthesia and the complications of surgery These certainly are not the facts. The first challenge is to determine which treatment is better for the patient in terms of cure and risk. Some tumors are radioresistant, and it is folly to try to treat them with radiation. However there are definite instances in which irradiation plus surgery or irradiation alone is desirable Even in these selected cases complications frequently arise.

RADIATION REACTIONS

General reactions—Patients exposed to radiation sometimes develop systemic complaints. There may be loss of appetite nausea, vomiting, diarrhea, loss of weight, headache and dizziness In addition, there may be a decrease in the number of circulating white cells in the blood stream (leukopenia) This reaction can be so severe that the patient must remain in bed. The outcome may even be fatal if the condition is not recognized.

Local reactions—Vesiculation of the skin and inflammation of the mucous membranes are not unusual following radiation therapy Associated with these is a varying degree of pain The onset and degree of these reactions will vary with the number of treatments dosage and tissue tolerance. These reactions however usually begin to subside within a few weeks

NECROSIS OF SOFT TISSUE.—In the attempt to direct the radiation to

underlying cancer, the normal tissues are affected If the normal tissues are more sensitive than the tumor tissue, they may be destroyed first To decrease this possibility, filters and application of the central rays in different directions are used (Fig 98, p 231) Thus rays may be directed through several surface areas (portals, cross-firing) to the tumor, thereby avoiding a damaging dose to a normal area

NECROSIS OF BONE —Irradiated bone has neither the vitality nor the healing properties of normal bone The periosteum may be swollen and readily stripped from the bone Histologic examination reveals either a decrease or an absence of osteoblasts The walls of the blood vessels are thickened, with reduction in both the size of the lumen and the blood flow.

Long bones may show these changes, yet osteoradionecrosis seldom develops because they are not usually exposed to infection. In the oral cavity, however, certain factors such as trauma (due either to occlusion or to extraction of a tooth), the presence of bacteria and the possible occurrence of gingivitis and periapical infection must be considered. Osteonecrosis is an unfortunate complication in the radiation treatment of cancer of the oral cavity (76)

During or after radiation therapy, certain symptoms sometimes appear after a variable latent period The gingiva may become inflamed, ulcerated and painful and the breath may be foul This may be followed by gingival recession, periodontitis and loss of alveolar bone The teeth become loose In the later stages osteonecrosis, osteomyelitis and osteosclerosis of the jaws occur, with loss of teeth and the formation of sequestra This sequence of events was reported in watch dial painters who ingested radium compounds by pointing the brush with their lips (Fig 118) (82, 87)

Not infrequently, serious sequelae develop following what is considered to be a simple extraction of a tooth in a patient who has had radiation therapy for oral cancer Removal of teeth is not without danger even as long as eight years after irradiation It is best to extract one tooth at a time with a minimal amount of trauma Some have advocated the removal of teeth by the appropriate application of rubber bands (p 163) The patient should be given adequate antibiotic therapy.

Acute abscesses and osteomyelitis may develop early When the osteomyelitis becomes chronic, abscesses have to be incised and drained and considerable purulent discharge continues for long periods. If

he infection involves the masticatory muscles, trismus may result Sequestration frequently follows although it may be delayed as long as several years Attempts to hasten sequestration by surgical removal may be followed by further bone necrosis With loss of bone, scarring

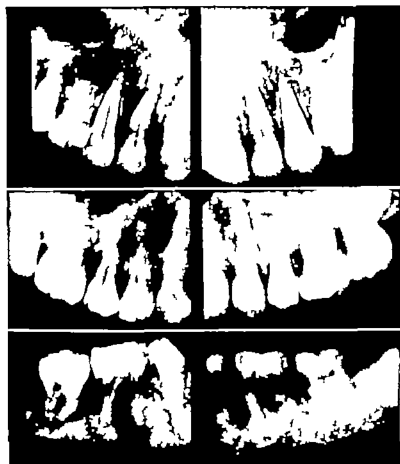


Fig. 118.—Jaws and teeth following radium poisoning in a watch dial painter Note areas of osteosclerosis as well as cervical caries of some teeth. (Courtesy of Dr W W Dalitsch, from Schour I and Sarnat, B G J.A.M.A. 120 1197 1942.)

and deformity frequently follow A most severe and prolonged pain may be associated with this condition. It may eventually cause death. Consequently it may sometimes be better to let the tooth exfoliate spontaneously rather than to extract it.

EFFECTS ON SALIVARY GLANDS AND TEETH —When radiation is directed to the oral cavity the salivary glands may be in the path of the rays and thus be injured. The secretory epithelium is destroyed, particularly

XXXIX

Palliative Treatment

PALLIATIVE TREATMENT is required (1) if the cancer is too advanced for either surgical or radiation treatment and (2) if the growth has not been completely removed or destroyed by either surgery or radiation

In other words, when there is no hope of cancer control, the patient must be made as comfortable as possible during his remaining days This is an important phase in the treatment of patients with oral and facial cancer. Their problems will be concerned primarily with (1) pain, (2) dysfunction, (3) malnutrition, (4) infection, and (5) mental reaction to the diagnosis.

PAIN

Local control of pain —The pain associated with intraoral cancer may be localized to the particular area involved or referred to other areas of the face and neck When the tumor is infected, removal of the infection will frequently reduce the amount of pain The application of topical anesthetics (Pontocaine or cocaine) will also control the pain to some extent Lozenges containing an anesthetic agent can be allowed to dissolve slowly on the tongue The blocking of a nerve by the injection of procaine hydrochloride will produce transitory local anesthesia and give an indication of the relief to be expected from either alcohol injection or nerve section The injection of alcohol does not always have a permanent effect

Sometimes resection of the fifth cranial nerve central to the ganglion or of some of its peripheral branches is necessary to obtain a permanent result If pain is caused in other regions because of metastases, the aforementioned treatment can be performed on the proper nerves The patient, of course, will have the annoyance of anesthesia in the area

of distribution of the anesthetized or sectioned nerve X ray therapy is effective in reducing pain especially when it is caused or aggravated by infection. Pain due to metastases to bone may in many instances be relieved by radiation.

Systemic control of pain.—The use of anodynes, sedatives and hypnotics is important in palliative treatment (31) The minimal effective dose should always be used. Aspirin and barbiturates are to be preferred as long as they are effective. However eventually codeine and later a more effective drug, such as morphine, will have to be employed (89) As long as possible, codeine should be used because addiction to codeine does not develop as early as addiction to morphine and there are fewer side reactions. A number of valuable proprietary drugs are also available. Two excellent pamphlets, "The Relief of Pain in Cancer Patients" (Supp no 121) and "The Prescribing and Dispensing of Narcotics under the Harrison Narcotic Law" (Pamphlet no 56) can be obtained from the Superintendent of Documents United States Government Printing Office Washington, D C.

Snake venom has been injected with definite success for relief of pain from cancer This is also true of procaine hydrochloride (0 1–0.2 per cent) administered intravenously Some progress has been made in the control of pain of specific types of cancer Thus, injections of certain hormones such as testosterone propionate give some relief for bone metastases of cancer of the breast, and the estrogenic hormones such as diethylstilbestrol for those of cancer of the prostate. Castration, whether it be hormonal, surgical or by radiation has been shown to be of benefit.

Dysfunction

The masticatory apparatus may be affected either in whole or in part in the patient with intraoral cancer Depending on the location of the growth, various portions of the mandible may be destroyed and a pathologic fracture may result (Fig 23 p 72) If the masseter internal pterygoid or temporal muscle is involved the patient may have trismus Pressure of the primary tumor (or metastases) on the pharynx or esophagus may cause difficulty in swallowing Pressure on the entrance to the larynx or the trachea may cause difficulty in breathing and necessitate a tracheotomy

The patient who has had surgical removal of part of his jaw or a pathologic fracture will require an appliance and possibly a bone graft

to maintain the correct position of the fragments (Table 12, p 247) Sometimes the salivary glands, because of radiation effects, do not secrete and the patient suffers from a dry mouth The diet should be adapted to cope with this problem

Malnutrition

Cancer is a wasting disease The tumor grows to the detriment of the host In well nourished individuals the tumor usually grows more rapidly than in poorly nourished individuals In addition, there may be a decreased food intake because of (1) loss of appetite, (2) toxemia (3) pain, (4) mechanical obstruction of the oral cavity by the tumor mass, and (5) inability to chew because of some disturbance of the masticatory apparatus.

To offset the increased demand for nourishment by the tumor and the decreased food intake and difficulty in swallowing, an adequate diet must be carefully planned not only in terms of calories, proteins, minerals, vitamins and fluids but in terms of consistency, attractiveness and absorbability

Feedings should be given frequently during the day, at one or two hour intervals if necessary An experienced dietitian can usually plan a satisfactory diet for the patient There should be no unusual difficulty in supplying this in the home

When the patient is able to take only a liquid or semiliquid diet and has difficulty in swallowing, an Asepto or large Luer syringe with an attached rubber tube can be used The tip of the tube is placed in the pharynx and the contents of the syringe are emptied. If this procedure is not adequate, a nasal tube may be inserted into the oral pharynx, esophagus or stomach Sometimes an opening through the abdominal wall to the stomach (gastrostomy) is made by which food is passed directly into the stomach The weight of the patient should be carefully watched

Complete blood counts should be done periodically, and when necessary blood transfusions should be given In addition, the blood should be analyzed for deficiencies in essential substances, which should be maintained at normal levels

Infection

Bacteria are normally present in the oral cavity When the resistance of oral tissue is lowered these organisms invade it and produce a sec-

ondary infection. This of course, is true of oral cancer Trauma from mastication and speech contribute to the successful establishment of the infection, as do moisture, warmth and lack of bactericidal light. As the growth advances the amount of infection increases This has two untoward effects (1) The patient may become toxic (and thereby also decrease his food intake) (2) Protein is wasted in the production of purulent material.

Several effective procedures may be used to reduce the infection The mouth should be kept as clean as possible by proper oral hygiene. This requires cleansing of the teeth and mucous membrane by cotton applicators, soft tooth brushes, hydrogen peroxide warm normal saline and flavored mouth washes and irrigations

Chemotherapy and antibiotics can be employed when indicated. They should be administered systemically not locally They are not to be substituted for proper surgical treatment such as the incision and drainage of abscesses, but should be used as supplementary therapy Hot wet dressings or wet packs with Dakin s tubes incorporated for continuous irrigation with normal saline or half-strength Dakin s solution are also of value. The use of either zinc peroxide (activated), balsam of Peru or 2-5 per cent urea packs also tends to clean necrotic wounds. Judicious use of x rays will help control infection

Mental Reaction to the Diagnosis

The emotional impact on the patient and his family when told that he has cancer (treatable or untreatable) cannot be overestimated Fear of death, of pain, of change in economic status are only some of the major emotional and social problems faced by the patient and/or his family Even when the patient is not told the diagnosis he may suspect it, and his concern and anxiety add to his discomfort. Thus, the social and emotional as well as the physical problems must be given careful consideration. The specialist who makes or confirms the diagonsis and the family doctor who is usually responsible for the terminal care must both be concerned with these aspects of the problem

It is important that the physician act as a kind and sympathetic friend and make his patient as comfortable as possible, giving him maximal help and securing from him his best co-operation The patient is greatly eased by having his questions answered as honestly as possible If aware of the diagnosis he should be allowed to talk about the meaning cancer has for him his acute anxieties and his fears. The

patient is also helped if his family is given an opportunity to talk about their fears and anxieties and to understand as fully as possible the patient's medical problem Unrealistic reassurance to the patient should generally be avoided because it gives little lasting comfort and usually brings ultimate distress

Many patients who suspect cancer and do not voice their suspicion, so as to protect their families from worry, maintain their guarded silence at considerable cost to themselves There are always some who do not want their suspicion confirmed The physician who really knows his patient, and who allows him to talk about his illness, can soon decide if it is wise for the patient to know the diagnosis On the other hand, for some patients the suspense and anxiety created by not knowing is much more disturbing than a sympathetic factual explanation of the diagnosis.

Constructive planning of an immediate nature should be stressed in discussions with the patient and his family For example the doctor would do well to encourage the patient to keep active as long as possible at his usual pursuits Continuing with his job will help divert his energies from futile anxiety and self-pity into constructive channels The physician may make suggestions to the patient and his family which will help them adjust their present mode of living to the new limitations which the disease might impose

The patient who is confined to the home or bed, however, no longer has these outlets and he may therefore have additional need to talk of his feelings This is also likely to be a time of increased anxiety on the part of his family. The understanding physician can do much to relieve these tensions by listening, explaining and offering concrete suggestions Occupational therapy, in either the home or the hospital, has definite value in helping the patient focus his attention outside himself In this way he can satisfy his need for useful activity

DON'T FORGET THE PATIENT AND HIS FAMILY FOR THE DISEASE

XL

Occupational Hazards from Exposure to Radiation

ALTHOUGH x and gamma rays are clinically invisible insensible and unnoticeable at the time of their penetration of tissue, they affect and destroy cells (54, 61 90) In addition, it must be pointed out that x ray and radium have cumulative effects and may also be carcinogenic (65) This was first shown, after a latent period of 10 years by the tragic appearance of skin cancer among a number of pioneers in radiology

X rays have been used to induce cancer in experimental animals. Their mode of action is not clearly understood, but x rays are known to produce mutations in sex cells It has been assumed that an analogous change may occur in somatic cells

The hazards are not limited to x ray specialists in fact, they appear to be higher among general practitioners and surgeons (61) The dentist, physician and technician must, therefore be cautious in their everyday activity of taking roentgenograms The temptation to hold the x ray films in order to expedite the process and assure proper positioning has resulted in destructive changes of the fingers (Figs 120 and 121) Adequate protection through regular and proper calibration of the x ray apparatus, as well as through efficient shielding of personnel, is essential to reduce radiation hazards

METHOD OF DETECTION OF EXPOSURE TO RADIATION

One must consider the effect not only of direct but also of scattered secondary radiation A relatively simple method can be used to determine whether one is being exposed to radiation A paper clip can be slipped over a dental x ray film packet (Fig 122, A) and the packet

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DON'T FORGET THE PATIENT AND HIS FAMILY FOR THE DISEASE

then fastened to the hand by cellophane tape Another similarly prepared packet can be slipped into a pocket of the gown or vest with the emulsion side of the film facing the possible source of radiation If the individual is being exposed to radiation, the outline of the paper clip

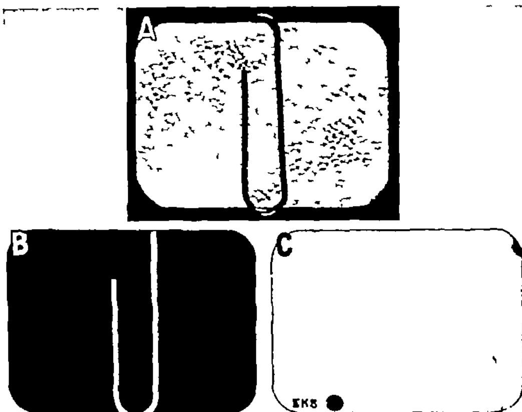


FIG. 122.—Clinical method of determining exposure to radiation A, dental packet with paper clip attached. B and C films exposed to different amounts of radiation. Note outline of paper clip.

will show on the developed x ray film (Fig 122, B and C) A control film should also be developed.

The results of this test should be evaluated initially within the first 24 hours Exposure to radiation should be eliminated at once. The test should then be repeated with the film exposed for longer intervals A radiosensitive dosimetric film badge especially designed for this purpose is available and is preferred to the method just described

Local Signs and Symptoms of Exposure to Radiation

Unfortunately the doctor in whom cancer develops from radiation exposure is often taken unawares because the cancer may develop



FIG 120 — Acute radiodermatitis Ulceration of a technician's finger following about two hours of careless exposure during diagnostic x-ray procedures



FIG 121 — Chronic radiodermatitis Hand of a dentist who had been holding intraoral films for patients during period of exposure to x-rays for 15 years Note irregularity and thickening of thumbnail and thickening and desquamation of skin of thumb and middle finger Hyperpigmentation, telangiectasis and atrophy of the skin are present

Questions for Students

1 What are the accepted methods of treatment of oral and facial cancer?
2 When a patient has cancer and syphilis at the same time, what is the treatment?
3 What are the advantages of radiation therapy over surgery?
4 What rays does radium emit?
5 Which ray is most capable of destroying cells?
6 Do radiations destroy surrounding normal cells as well as cancer cells?
7 Are all tumors radiosensitive?
8 How does one determine whether a tumor is radiosensitive?
9 How soon after irradiation may dental treatment be resumed?
10 Should all teeth be extracted before irradiation?
11 After the jaws have been irradiated, what are the dangers of tooth ex traction?
12 What happens to the tumor tissue which is exposed to radiation?
13 What measures are taken to protect the salivary glands and other tissues during radiation therapy?
14 Why is it good policy to know whether a patient has had radiation treatment in the oral cavity?
15 If a patient is to have irradiation of the mouth for cancer when should the teeth be extracted? In cases of carcinoma of the mouth where teeth are found in the area of the tumor mass would you extract the teeth before directing treatment toward the tumor itself?
16. How long does it take for the effects of either radium or x rays to wear off so that dentures may be constructed?
17 What is the role of the dentist in regard to the patient who is to have radiation therapy?
18 What is the effect of radiation on teeth? Bone?
19 What are the occupational hazards of x ray exposure?
20 What is the rationale of surgical treatment of cancer?
21 What are the indications for surgical treatment of cancer? Contraindi cations?
22 What are the indications for neck dissection of lymphatic elements in carcinoma of the mouth tongue and lip when no lymph nodes are palpable?
23 What is the role of the dentist in surgical reconstruction about the face and jaws?
24 Is it advisable to repair immediately any postoperative defect or should one observe the patient a few months for recurrence?
25 What are the tests or indications that the cancer cells have all been removed by surgical treatment or destroyed by radiation?
26 How long should a patient be followed by re-examination after having been treated for cancer?
27 What is a five year cure? Five year survival?
28 What happens to a patient with untreated cancer? What causes death?

only years after the original insults Too often, suspicion is aroused only after ulceration has developed However, there are early symptoms for which the doctor must be on the alert X-rays affect the appendages of the skin early Consequently, the sweat and sebaceous glands are inactivated and the skin becomes dry The hair follicles are similarly sensitive to x-rays, so that hairy areas become hairless In addition, the skin becomes pigmented and thickened due to hyperkeratosis and proliferation of connective tissue (Fig 121) Telangiectasis may be present in the areas. The blood vessels become obliterated and the surface temperature is lowered as a result of decreased circulation The skin becomes shiny, firm and immobile The finger-nails crack, become irregular, fissured and develop white spots Eventually the tissue breaks down and necrosis and chronic ulceration occur

These changes are similar to those observed in patients in areas which have been irradiated for either benign (Fig 36, *A*, p 113) or malignant tumors, acne, pruritus or pain

The doctor should seek proper consultation the moment his fingers show any of the aforementioned signs and symptoms Treatment of these lesions is much simpler and far more effective when instituted early When the symptoms are given attention at a later stage, the lesions may already be cancerous.

DIAGNOSTIC RADIATION IN CARELESS HANDS MAY PRODUCE CANCER

Questions for Students

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29 What is the cause of death when there is no metastasis to vital organs such as the lungs and liver?

30 Discuss the family physician's responsibility in the treatment of a patient with oral and facial cancer List specific procedures to be performed

31 Discuss the family dentist's responsibility in the treatment of a patient with oral and facial cancer List the specific procedures to be performed

32 How soon after surgical treatment can a prosthesis be applied?

33 Is the dentist equipped to produce facial prostheses?

Appendix

Do's and Don'ts

Do s

1 *Do listen* attentively to all of the patient s complaints
2. *Do examine* the entire oral cavity face and neck.
A cursory oral examination alone is not adequate.
3 *Do remove* all sharp rough areas from teeth, fillings and artificial dentures
4 *Do rule* out cancer first.
5 *Do refer* every patient suspected of having oral or facial cancer at once.

Don ts

1 *Don t limit* your examination to the teeth.
2. *Don t apply* caustics or treat any suspicious lesion of the mouth or face until cancer has been ruled out.
3 *Don t delay* referring a patient with suspected oral or facial cancer
4 *Don t watch* the cancer grow
5 *Don t extract* loose teeth adjacent to a cancer without first consulting the one treating the cancer
6 *Don t extract* teeth from a patient who has been irradiated for cancer of the mouth before consulting the radiotherapist.

Danger Signals of Oral and Facial Cancer

With rare exceptions, there is no pain at the beginning of any cancer By the time the pain is felt, the cancer is usually far advanced. There are, however, certain symptoms or danger signals which may indicate the possibility of cancer These are.

1 A painless lump or thickening.
2 Any sore that does not heal and remain healed after two to three weeks.
3 Progressive change in the color or the size of a wart, mole, or birthmark.
4 Chronic progressive white thickening on either the lips or oral mucosa
5 Bleeding or discharge
6 Swelling of the jaw, asymmetry of the face.
7 Difficulty in opening the mouth.
8 Sudden appearance of a swelling of the neck
9 Difficulty in swallowing, persistent hoarseness or unexplained cough.

Any of these symptoms indicates that *something* is wrong and it *may* be cancer. A specialist should be consulted at ONCE when symptoms or irregularities are detected *Early discovery means early recovery*

Treacherous Nature of Cancer

1 Trivial early symptoms.
2 Tenderness or pain absent in early stages.
3 Time is crucial
4 Terminal if untreated.

Recapitulation

1 Cancer of the oral cavity and face is a common form of cancer It may be present without producing symptoms
2. The public should be more alert and concerned about growths and sores of the face, mouth and neck occurring not only in adults but also in children
3 Cancer of the oral cavity and face can be diagnosed early if a complete examination is done.
4. The first sign of either oral or facial cancer may be a swelling of the neck
5 An annual health examination must include a complete examination of the face, mouth and neck. Only in this way can precancerous and early cancerous lesions be detected.
6. Oral and facial examination and microscopic study of biopsy tissue are the most reliable methods of detecting cancers while they are in a curable stage.
7 Cancer of the oral cavity and face is a curable disease
8 The rate of cure is greater with earlier diagnosis
9 The individual who treats himself for chronic growths and sores of the mouth, face or neck has selected the wrong "physician."
10 The surgical removal and/or irradiation of a cancer of the mouth and face are the accepted methods of treatment

EVERY PATIENT SUSPECTED OF HAVING CANCER IS ENTITLED TO IMMEDIATE EXPERT CONSULTATION THE FAMILY PHYSICIAN AND DENTIST PLAY AN IMPORTANT ROLE IN THE EARLY RECOGNITION OF CANCEROUS AND PRECANCEROUS LESIONS

Procedure When Cancer Is Suspected

1 Take a complete pertinent history.
2 Do a complete oral, facial and neck examination
3 Record all information carefully, including your tentative diagnosis
4 Tell the patient that you have made a tentative diagnosis, but that it is important that a specialist be consulted at once for a definite diagnosis
5 Give the patient the exact name, address and telephone number of the consultant
6 If possible, call the consultant and make a definite appointment while the patient is still in your office
7 If you do not know to whom you can refer your patient, inquire from your local or state medical society
8 Discuss with a close, responsible member of the family the need and reasons for early consultation with a specialist.
9 Check with the consultant to be certain that the patient has kept his appointment
10 The specialist is responsible for the final diagnosis and treatment
11 In the case of proved cancer, maintain your interest in the patient and include in your office record the histopathologic diagnosis of the biopsy, treatment given and post-treatment course
12 Co-operate with the physician and the tumor clinic in regard to oral care
13 Immediately refer the patient back to the specialist in case of any suspicion of recurrence

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